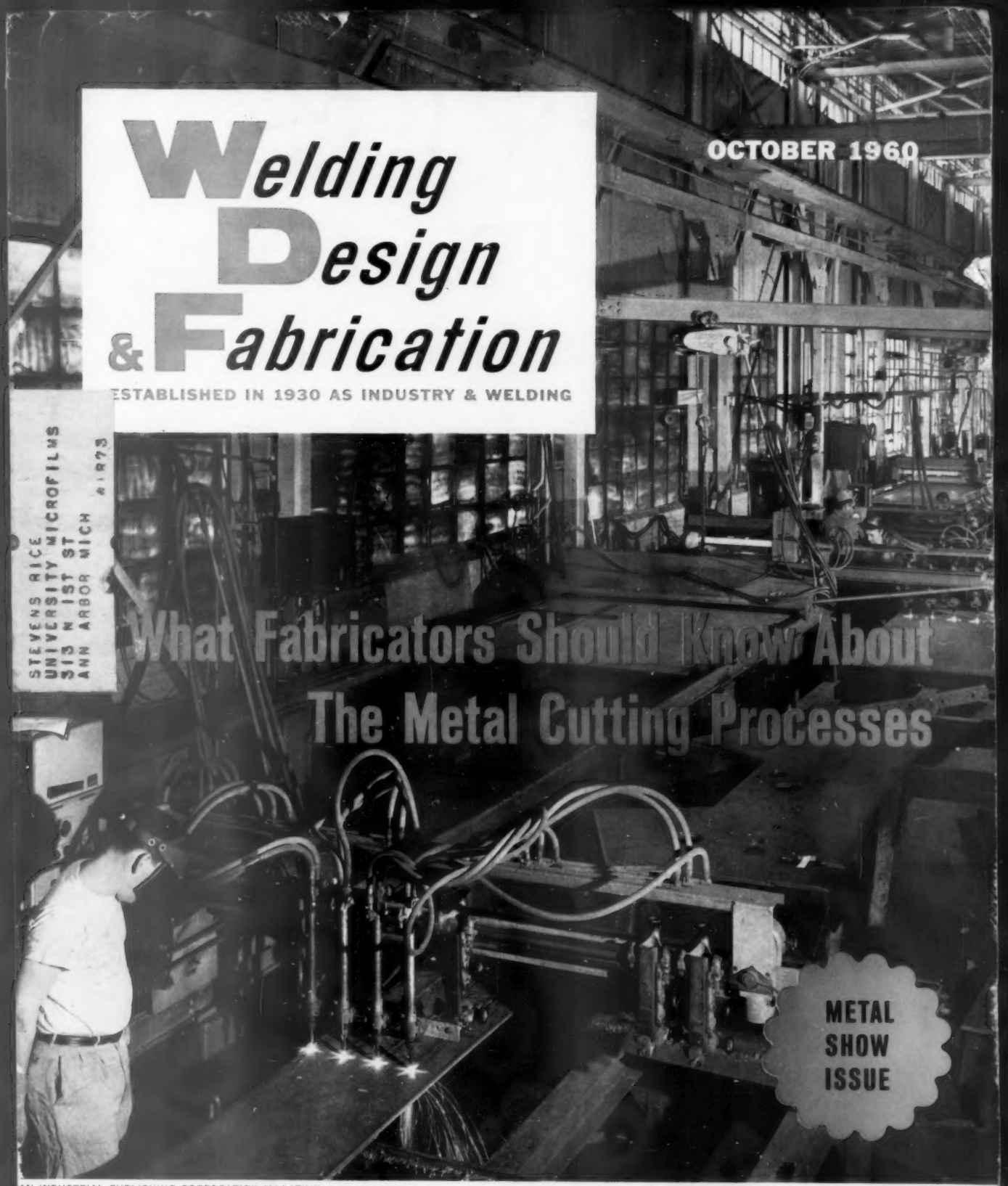

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OCTOBER 1960

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METAL SHOW ISSUE

AN INDUSTRIAL PUBLISHING CORPORATION MAGAZINE

ALSO IN THIS ISSUE

TECHNIQUES FOR FABRICATING THE HEAVIER CLAD STEELS

5 WAYS TO IMPROVE YOUR SPOT WELDING QUALITY

WHAT WE NOW KNOW ABOUT ELECTRON BEAM WELDING

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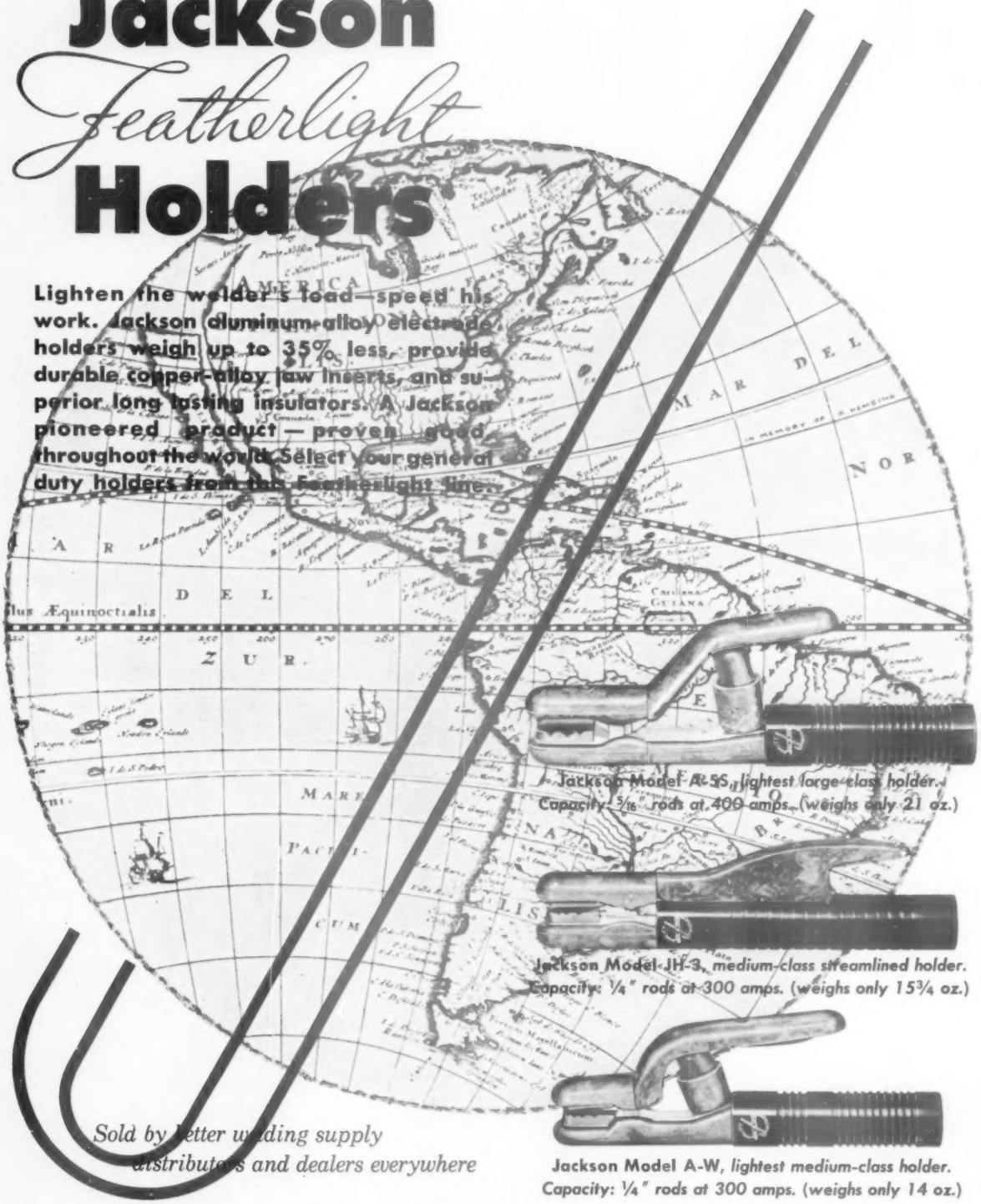

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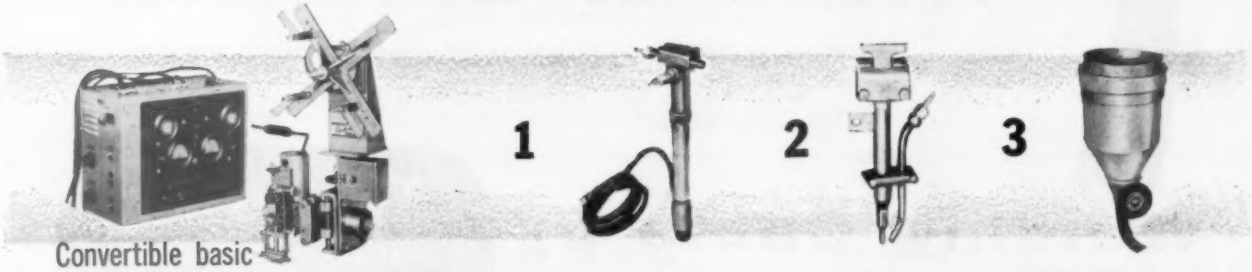

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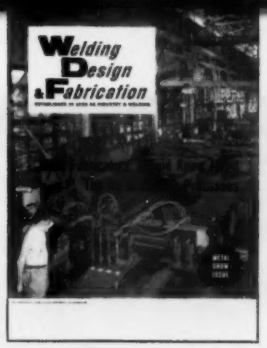

for October, 1960

COVER: Thew Shovel Company, Lorain, Ohio, uses six electronic-tracer multiple-torch flame cutting machines to make parts for its all-welded earthdigging and moving machines. Just recently, the company experimented on 200 small piece-parts up to one-inch thick. It found that flame cutting reduced operating time, increased production, and saved $6,700 over previous methods. In fact, whenever Thew reorders a part for a weldment, their engineers try to redesign it for flame cutting if at all possible.

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39 THE NEWEST WAYS TO CUT AND JOIN MAGNESIUM
The world's lightest structural metal is showing up in more and more products; here are significant developments you should know about.

42 TECHNIQUES FOR FABRICATING AND WELDING HEAVY CLAD STEELS
Clad steels thicker than two-inches are as easy to handle as their thinner gage cousins, if you consider slight differences in techniques.

44 FIVE WAYS TO IMPROVE YOUR SPOT WELDING QUALITY
Westinghouse uses flexible tooling and careful planning to spot weld electronic equipment that meets rigid military specifications and tolerances.

46 HEAT EXCHANGER TUBE WELDS ARE RADIOGRAPHICALLY SOUND
A fully automatic production line turns out high quality, accurate tube-and-cap assemblies which are inspected right on the production line.

50 PORTABLE CLEAN-ROOM PREVENTS CONTAMINATION DURING WELDING
American-Standard uses a portable, expandable clean-room to control airborne dirt and dust during welding of heat exchanger equipment.

52 WHAT WE NOW KNOW ABOUT ELECTRON BEAM WELDING
Has this process been oversold? Or does it really have a future? Here's what one manufacturer of electron beam welders thinks.

54 WELDING AND FABRICATING WORLD'S LONGEST ZIRCONIUM TUBES
Three companies pooled their welding and fabricating know-how to produce these zirconium tubes to hold a nuclear reactor's fuel elements.

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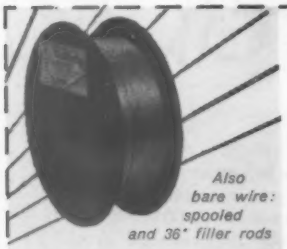

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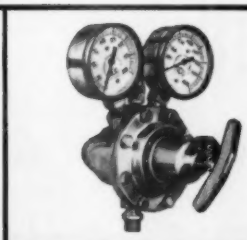

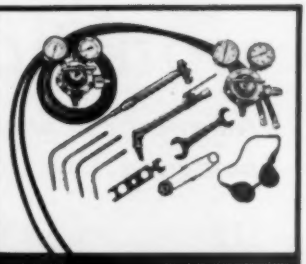

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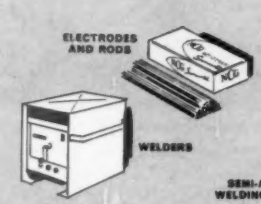
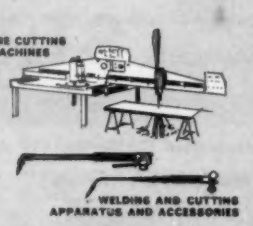


SEMI-AUTOMATIC WELDING PROCESSES



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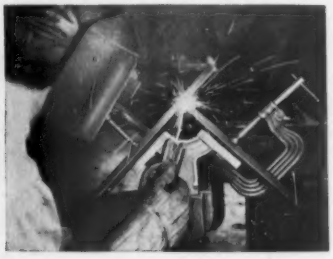

THREE TYPES OF HOLDERS — easily combined for multiple joints:

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LETTERS

to the editor

WELDED BRIDGES

Editor:

Please accept my expression of appreciation for your article on welded highway bridges in your August issue.

You may be interested in the approach which I have taken in a recent letter to the United States Steel Corp.

Our highway department is building practically no bridges of less than 90-foot span with steel. Prestressed concrete has taken that market although we weld them 100 percent.

P. V. Pennybacker,
structural engineer
Austin, Texas

• *In his letter to U. S. Steel Corp., Mr. Pennybacker said that proper welded designs, properly constructed, would effect greater savings and serve customers better than bolted designs. He also said those people who make the decisions on what materials to be used in bridges and what fabricating process should be used need much more education on welded design.*

IMPACT OF CRYOGENICS

Editor:

We enjoyed reading "The Impact of Cryogenics on the Welding Industry" in the August issue of WELDING DESIGN & FABRICATION. We feel many of our customers will be very interested in this article.

Would it be possible for us to receive 20 copies of this article. Thank you very much. If we get these copies, you may be assured they will be put to very good use.

Robert S. Smith,
sales manager,
AWECO Supply Company

• *A limited supply of tear sheets of the article on cryogenics is available as long as they last. Complete copies of the August issue in which this article appeared are available at 75 cents each. Send check or money order to: The Editor, Welding Design & Fabrication, 812 Huron Road, Cleveland 13, Ohio.*

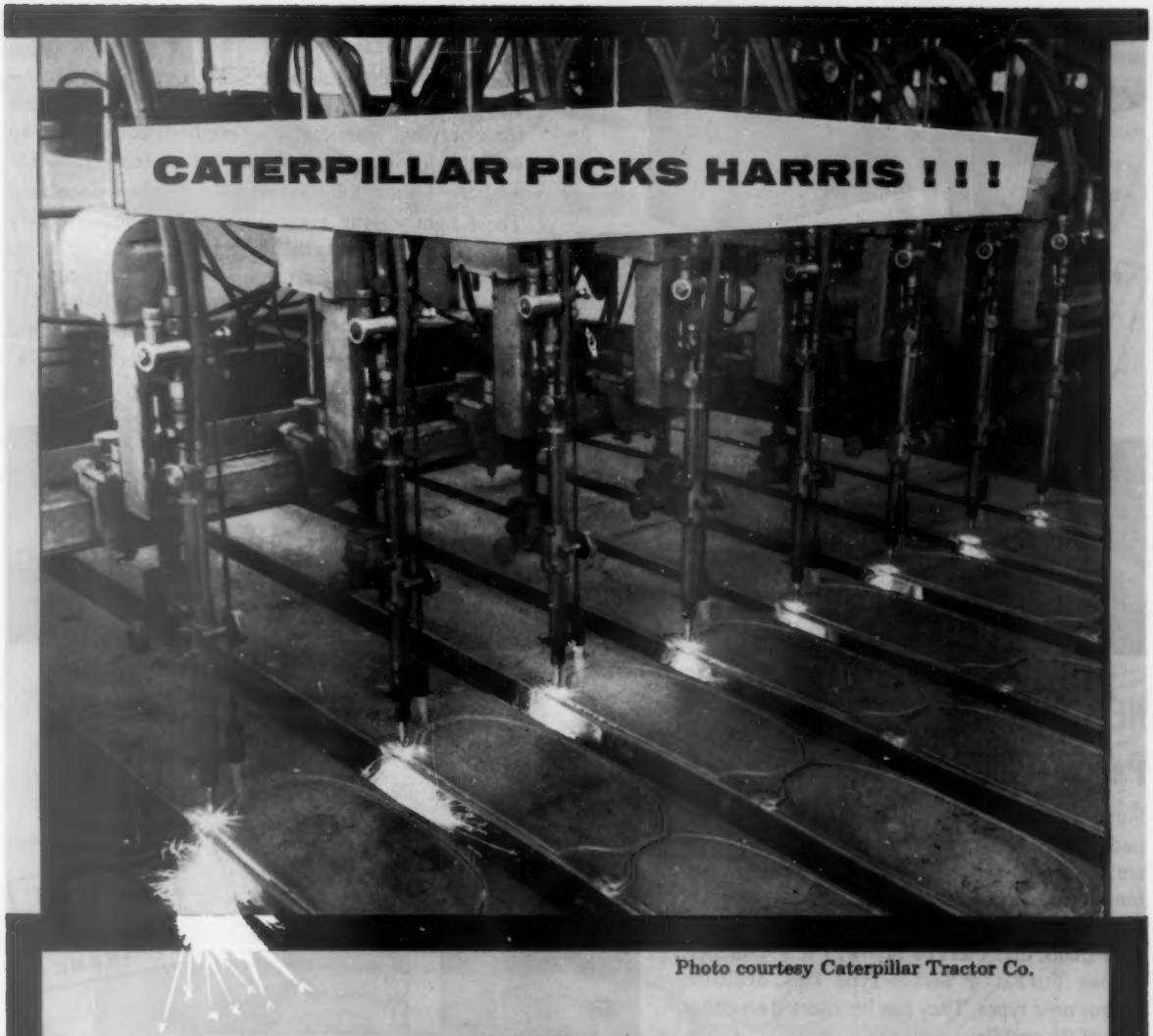

Photo courtesy Caterpillar Tractor Co.

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This installation permitted performance not otherwise possible and the gas savings are substantial.

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For More Information Circle No. 53 on Reader Service Card.

NEW All-Aluminum Offset Holder

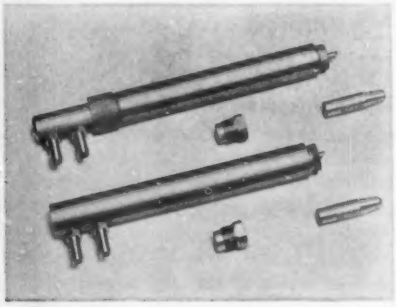
You'll pay less for this new TUFFALOY offset holder—and get more benefits too. Only a complete departure from previous manufacturing methods could come up with this low-cost, high quality holder (each holder is a 'slice' of a giant aluminum extrusion).

These light weight, corrosion resistant holders carry threaded tip adapters that take the brunt of the wear, always encountered in the tip socket. To change tip size from a 4 RW taper to a 5 RW taper (Nos. 1 & 2 M.T.), you change adapters, not holders. Standard 2- and 4-inch offsets, with shank diameters of ¾, ⅞, 1, 1¼, & 1½-inches.

NEW LOW-COST OFFSET SPOT WELDING TIP HOLDERS

NEW Simplified Paddle-Type Holder

Simplified design makes this new TUFFALOY paddle-type holder both lower in cost to use (no tee connector is needed) and more rugged and long-lived. An outstanding holder for spot welding in restricted areas. Standard 4-inch offset, with shank diameters of ¾, ⅞, 1 & 1¼-inches. It uses TUFFALOY Socket-Type Tips, available in four nose types. They can be inserted on either side of the paddle.



New this year are these Tuffaloy straight holders: The Goldcrown ejector type (top), and the Goldspot non-ejector type (bottom). The ejector holder features an entirely different method of ejecting tips. The sturdy brass head is moved forward, forcing a stainless steel ejector tube against the base of the tip. This mechanism *does not cause leakage*, usually associated with ejector holders.

Threaded adapters eliminate the need for reworking worn tip sockets, permit changing tip size without replacing the holder. In 8- and 12-inch lengths and in diameters of ⅞, 1, 1¼, & 1½-inches. For Nos. 4, 5, 6, & 7 RW taper tips.

Request the new TUFFALOY Catalog. It describes for the first time the RW Taper numbering system for spot welding electrodes.

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P&H hardsurfacing electrodes can be used to prevent wear and to prolong the service life on valuable equipment. What's more, hardsurfaced parts will in most cases outlast the original parts by two to twenty-five times!

Investigate both. Write for Bulletin W-158 which describes the welders — and Bulletin R-27 for information on the hardsurfacing electrodes.

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"Better Metals For A Competitive America" is theme of 42nd annual Metal Show

PHILADELPHIA: Because American industry, particularly metalworking, is facing serious challenges from foreign competition, the 42nd National Metal Show to be held here October 17-21 will spotlight the need for improved technology as a means towards improving our competitive position. More than 250 technical presentations will be made in symposium discussions, seminars, and formal sessions of the ASM and seven cooperating technical societies. These meetings will be held in several Philadelphia hotels.

Hundreds of American manufacturers will feature metalworking products at the Philadelphia Trade and Convention Center. Close to 1,800 experts in their fields will be on hand to answer specific technical questions.

Taking part in the Metal Show are ASM; American Institute of Mining, Metallurgical, and Petroleum Engineers; Metal Treating Institute; Industrial Heating Association; Special Libraries Association; Metal Powder Industries Federation; Society for Nondestructive Testing; ASM-AEC Joint Conference; and Ultrasonic Manufacturers Association.

STEEL ARENA

New to the Show is the Steel Arena which dramatizes one of the nation's basic industries and promotes steel as a basic construction material. Focal point of the Arena is a theme tower, constructed of solid steel with arched girders joined at the top and tapering gracefully to a 25 foot diameter platform below. Exhibits of 16 steel companies will be laid out in concentric circles, with aisles radiating like spokes in a wheel.

These companies are exhibiting welding equipment and accessories . . .

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Aerobraze Corporation
Ajax Electric Co.
Allison-Campbell Division
Aluminum Co. of America
American Chain & Cable Co., Inc.
American Optical Co.
American Pullmax Company, Inc.
Arcweld Mfg. Company
Arc Spot Welder Division,
Guthery Machine Tool Corp.

B

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Baiteau Electric Corp.
Banner Welder, Inc.
Bausch & Lomb Optical Co.
Beryllium Corp.
Branson Ultrasonic Corp.
Bron Weld Corporation
Budd Company

C

Crucible Steel Co. of America
Cryogenics, Inc., Division
of Hamler Industries, Inc.
Curtiss-Wright Corp.

D

Detroit Testing Machine Co.
Despatch Oven Co.

E

E. I. duPont de Nemours & Co.
Eastman Kodak Company
Engelhard Industries, Inc.
Exomet, Inc.

G

Gas Appliance Service, Inc.
General Electric Co.
Great Lakes Steel Corporation

H

Haynes-Stellite Company,
Division of Union Carbide Corp.

I

International Nickel Co., Inc.

K

KSM Products, Inc.
Kester Solder Co.

L

Lake Chemical Company
Lepel High Frequency Labs, Inc.

M

Magnaflux Corp.
Markal Company
Merrill Brothers
Mine Safety Appliances Co.

N

NRC Equipment Corp.
Narda Ultrasonics Corp.
National Carbon Company
National Ultrasonic Corp.
North American Philips Electronics

P

Picker X-ray Corp.
Precision Metal Molding (Publ)
Princeton Division,
Curtiss-Wright Corp.

R

Radionics, Inc.
Raytheon Corporation
Riehle Testing Machines Div.,
American Machine & Metals, Inc.

S

Selas Corporation of America
Smith Corporation, A. O.
Sperry Products Co.
Steel City Testing Machines, Inc.
Syntron Company

T

Tempil Corporation
Turco Products, Inc.

U

Ultrasonic Division,
Harris Transducer
Union Carbide Corp.

W

Wales Strippit, Inc.
Welding Design & Fabrication (Publ)
Wells Mfg. Corp.
Westinghouse Electric Corp.

For More Information Circle No. 90 on Reader Service Card.

Material Evidence — NOBODY PUTS AS MUCH INTO A WELDING MACHINE AS A. O. SMITH

To prove our case — that only A. O. Smith still makes an Extra-Heavy-Duty welding machine—we've put our evidence on the table. We submit that, while other machines have been "trimmed down" to sell for less, A. O. Smith Extra-Heavy-Duty welders have all the "guts" the old-timers had. That there has been no stinting on copper, iron or power. That there has been no attempt to cut corners on materials and components—no compromise with value to meet a price.

Examine the evidence! Then make your own value analysis. We are sure that the verdict will be in favor of A. O. Smith — that it's sound judgement to pay a little more for much more machine. Analyze the value when you consider the price. It's value that pays off in longer life and superior performance.

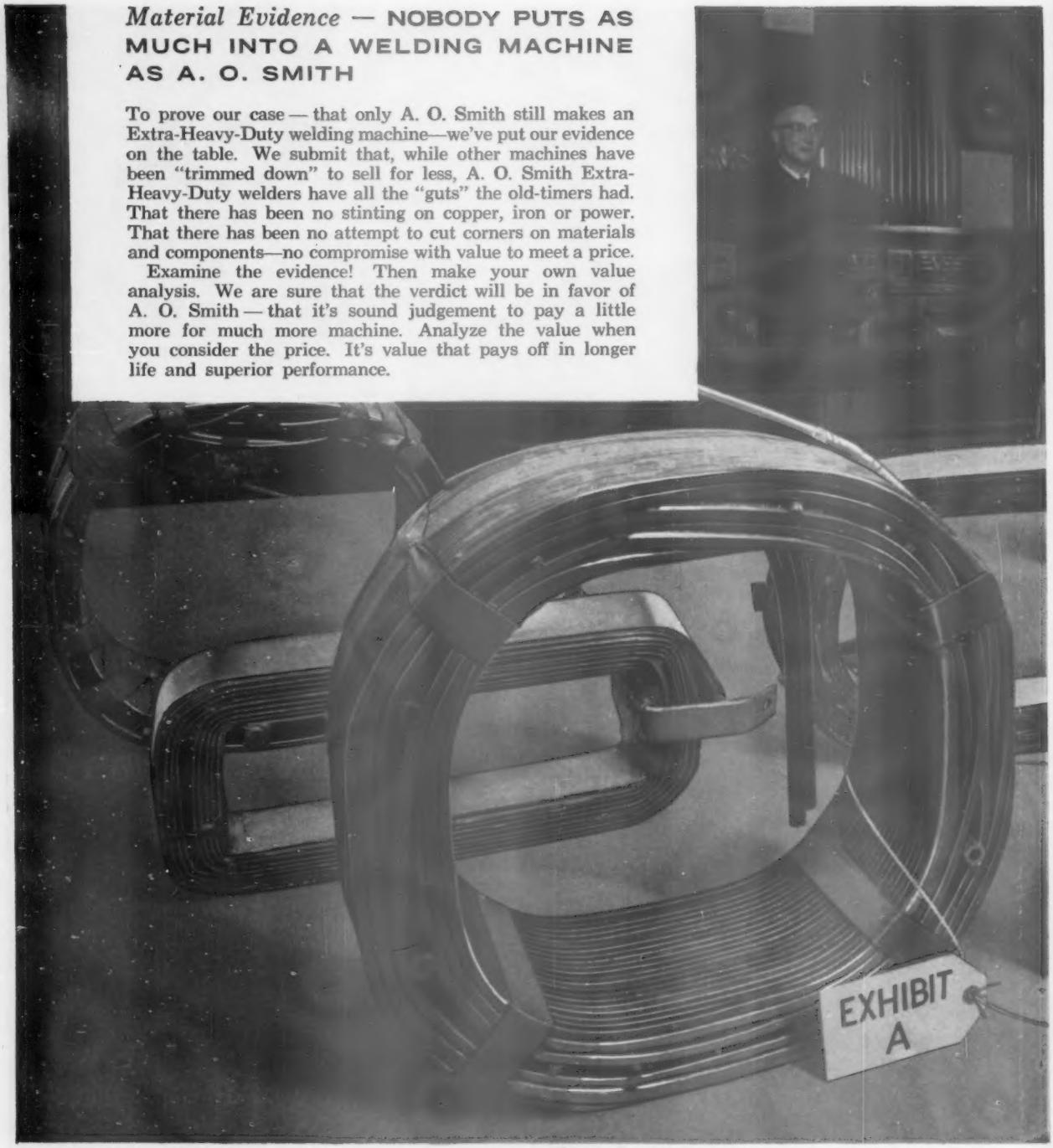

EXHIBIT A — COILS A. O. Smith's extra-heavy copper secondary (at left) and primary (at right) coils are the heaviest in the field — together weigh 185 lbs. Note how competitive coils skimp on material. Here's heavy-duty value that adds up to longer production life . . . a machine that operates on a temperature rise of only 55°C — lowest of any machine on the market.

EXHIBIT B — CAPACITORS Standard with A. O. Smith Extra-Heavy-Duty welders is the industry's maximum power factor correction — 134 M.F.D. total. This high power factor means that the current taken from the primary line is lower than with any other machine when comparable ratings are matched — value that means money in your pocket through lower power bills.

EXHIBIT C — MOTOR Power behind the A. O. Smith extra-heavy-duty cooling system is big, totally enclosed lifetime-lubricated motor. Note "junior-size" motors used by competitive welders. Only A. O. Smith's heavy-duty motor supplies dependable starting torque . . . provides more air for cooler operation and longer machine life.

EXHIBIT D — FAN Biggest fan in the field. Air is circulated by an 18-inch industrial-type fan blade as compared to fans much smaller on other welding machines. And A. O. Smith's blade is dynamically balanced, scientifically pitched to deliver maximum ventilation down through the coils. Blast guides direct full force of the fan right on target.

For More Information Circle No. 90 on Reader Service Card.

COURT CALENDAR

Case for value analysis — A. O. SMITH EXTRA-HEAVY-DUTY welding machine versus the field. Exhibits shown in front row on table are principal components used in the standard A. O. Smith EXTRA-HEAVY-DUTY welding machine. Comparable components used in other well known brand welding machines are displayed in rear rows.

Through research ... *a better way*

A.O.Smith
CORPORATION
WELDING PRODUCTS DIVISION
Milwaukee 1, Wisconsin
A.O. Smith INTERNATIONAL S.A., Milwaukee 1, Wis., U.S.A.

For More Information Circle No. 90 on Reader Service Card.

SILVER BRAZING SIMPLIFIED NOW, WITH FIRST FLUX-COATED ROD!

EutecSil® 1020 FC*...first flux-coated silver alloy ever available...new concept, new combination from core to coat...a fresh success from Eutectic's research. Biggest news is in the benefits to weldors: *no more fluxes to mix, apply, dry!* Flux always present in right amount. Ferrous, non-ferrous metals, joined equally well. Highest fluidity, lowest melting point, greatest strength. And more...

BENEFITS NEVER END...In addition to easier application and all the other features listed above, EutecSil 1020 FC is non-toxic: you can use it on food equipment. Also, it contains a built-in oxide remover. And EutecSil 1020 FC does not deteriorate. Unique flux eliminates "stub loss" between rods. Add to these advantages the fact that you stock only one product instead of two yet get a better joint, and you see why EutecSil 1020 FC... the latest "first" from Eutectic's research...is the greatest news of the year for weldors.

®Reg. T.M. Eutectic Welding Alloys Corp. *Patent pending

Please send complete literature on EutecSil 1020 FC

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ADDRESS..... CITY..... ZONE..... STATE.....

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Originator of the Low Heat Input process... The ONLY welding alloy manufacturer in the world capable of producing welding rods and electrodes from virgin metals to finished products in ANY metal.

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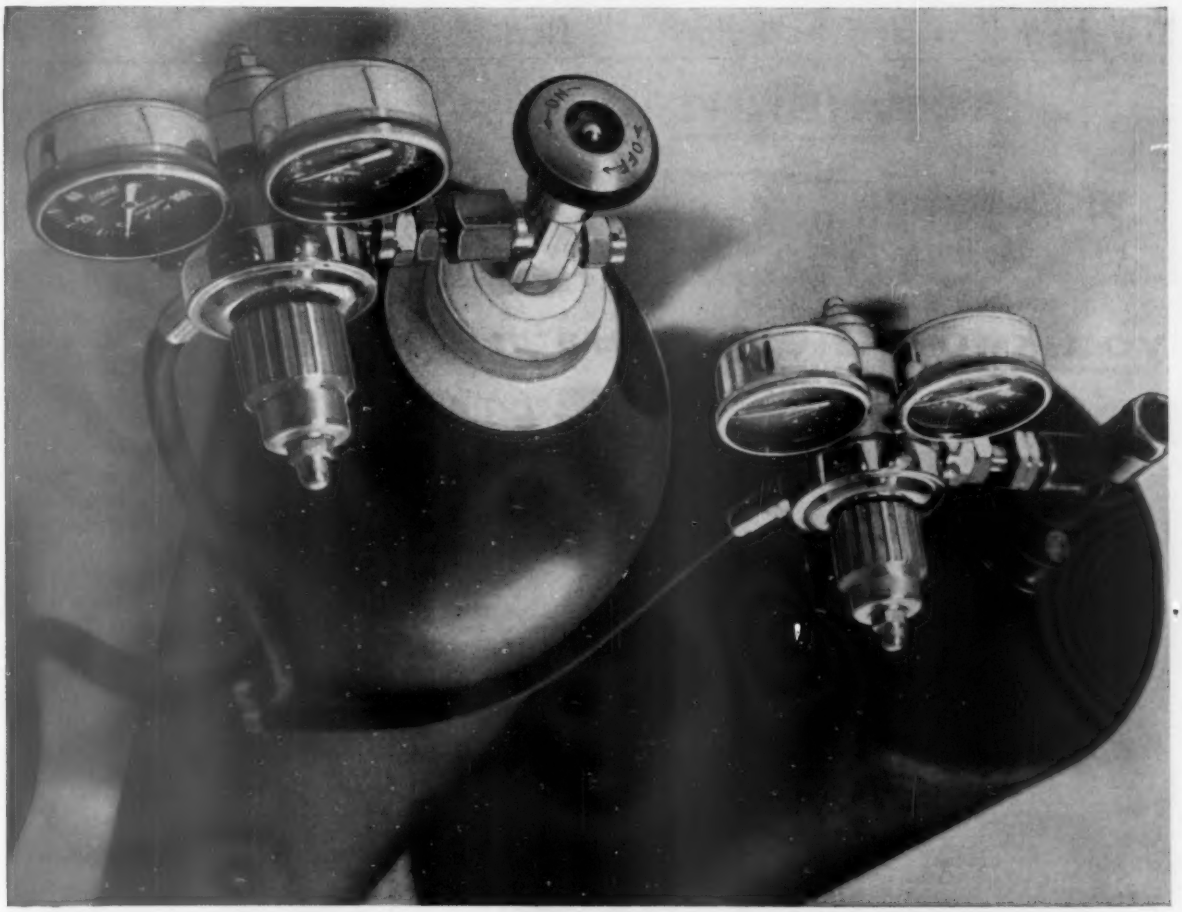

no other regulator is so easily adjusted, none are safer. and, no other regulator offers greater user satisfaction . . .

New and better equipment, in every industry, makes every job safer and easier to accomplish. Modernization is the keystone to all of our amazing industrial progress.

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INDICATORS

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LIBRARY

of welding

Aluminum Pipe Welding

"Recommended Practices for Gas Shielded Arc Welding of Aluminum and Aluminum Alloy Pipe," American Welding Society, Dept. T, 33 West 39th Street, New York 18, N. Y., 40-pages, $2.00.

The first national publication on gas shielded-arc welding of aluminum and aluminum alloy pipe has been prepared by the AWS Committee on Piping and Tubing.

A series of valuable tables is included in the book. These include a conversion table for the ASTM alloy designation and the corresponding commercial alloy number, recommended filler metals for welding various combinations of aluminum alloys, and actual settings for welding various pipe sizes and thicknesses.

Plastic Welding

"Making Better Plastic Welds," 56-pages, Laramy Products Company, Beachwood Street and Route 3A, Cohasset, Mass., $1.00.

This new instruction book contains 11-chapters on the welding of modern structural plastics. It was written by Donald W. Thomas of Laramy Products Co. in conjunction with other people familiar with welding practices and procedures being used today.

This first practical instruction book is written exclusively for the man who actually does the welding. Included are more than 100 illustrations, down-to-earth information, and many little-known tricks of the trade.

PRESSURE DESIGN

"Pressure Vessel and Piping Design" by the American Society of Mechanical Engineers, 29 West 39th Street, New York 18, N. Y. 700 pages. $10.00.

This is a monumental collection of fundamental information for designers of boilers, pressure vessels and piping systems. The book was compiled by experts who searched a vast number of technical papers and reports for key writings to include in the book. The ten sections deal with openings, bolted-flanged joints, heads, shells, piping, materials and fabrication, thermal stress and fatigue, loads and supports, external pressure and miscellaneous topics.

WELDING CLINIC

J. Imperati and R. F. Pulver, Welding Engineers
Anaconda American Brass Co., Waterbury, Conn.

Spooled copper electrodes and Aircomatic Process help simplify welding of heavy-duty connectors

Fabrication of copper cathode straps and anode flexes for an aluminum potline is simplified and expedited by inert-gas consumable-electrode welding using spooled electrodes of Anaconda Copper-372. At the Reynolds Metals reduction plant in Gregory, Texas, one operator makes 12 welds, each about ¾" thick by 3" wide, in 12 to 15 minutes, using an Aircomatic Model 21 torch, argon shield, and 3/32" diameter electrodes.

ANACONDA COPPER-372 Welding Wire, layer-wound on standard 25-pound spools, is carefully cleaned and shipped in a special carton. Supplied to Reynolds by Big Three Welding & Equipment Co., Corpus Christi, Texas.

TOUGH SERVICE CONDITIONS. Anode flexes installed on the potline are subject to very high temperatures. These are the same construction as the cathode straps, shown at left below, except that the flexible portion is longer.

The connectors consist of solid copper bus bars joined by flexible packs of 36 leaves of 24 B&S gage (0.0201"), 3" wide copper strip. The joints are welded over carbon back-up plates. Usually, welding of ¾" thick sections requires the use of single-, or double-vee grooves. Reynolds found that with inert-gas consumable-electrode welding, these butt joints can be made without beveled-edge preparation by simply spacing the edges ¼" apart.

The ease and speed of inert-gas consumable-electrode welding of copper has led to its widespread use, not only for joining bus conductors, but for the fabrication of pressure vessels and other equipment. Anaconda Copper-372 Welding Electrodes are available in sizes from .035" through ¼" on standard 25-lb. spools.

FOR MORE INFORMATION. Anaconda distributors will gladly help in the selection of the exact rod for your job. But if you have a special problem, Anaconda specialists will be glad to help you. For this service, or a copy of Publication B-13, "Anaconda Welding Rods and Procedures for Welding Copper and Copper Alloys," write: Anaconda American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario. 6021 L

A SKID load of completed cathode straps ready for installation on the potline.

ANACONDA®
WELDING RODS
Made by
Anaconda American Brass Company

For More Information Circle No. 9 on Reader Service Card.

What Hackney quality means to you

- Maintenance costs cut—smooth surfaces clean easily, paint quickly.
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- Uniform capacity, controlled weight—filling, handling and record-keeping are simpler.
- Rugged construction that lasts. Hackney has spelled quality since 1902.
- Far exceeds ICC specifications.
- Sound investment. Hackney quality costs no more, and it gives you extra features: accurate threading, neater appearance and legible stamping.
- Complete range of sizes and shapes—from small medicals to 220's, 250's and 300's (cu. ft.).
- Central shipping location means faster service, with less freight charges.

Economical, strong, safe Hackney cylinders are your dependable shipping containers for compressed industrial gases. Your nearest Hackney representative will be glad to give you complete specifications and quote prices.

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CONTAINERS AND PRESSURE VESSELS FOR GASES, LIQUIDS AND SOLIDS

For More Information Circle No. 79 on Reader Service Card.

MEN ON THE MOVE

in the welding industry

APPOINTMENTS:

McVICKAR

COYNE

Edward S. J. McVickar has been appointed manager of mining and welding cable sales, National Electric Division, H. K. Porter Company, Inc., Pittsburgh. McVickar, formerly mining and cable sales manager for General Cable Corp., is an active member of the National Welding Supply Association.

The board of directors of the Victor Equipment Company has announced the appointment of **E. J. Coyne** as vice president of the Gas Division. The Gas Division manufactures and distributes industrial and medical gases in the State of California. Coyne will headquarter at the San Francisco company's executive offices.

The Norton Company has announced three sales force appointments. **William C. Howard, Jr.,** was named supervisor of distributor sales promotion; **Edwin A. Danielson** was appointed abrasive engineer in the Connecticut district; and **John W. Peterson** became abrasive engineer in the Denver, Colorado, district. All three had previously served with the company.

Philip J. Parker has been appointed general sales manager of Sperry Products Company. **Mr. Parker** will supervise sales of all the company's products and services, railroad and industrial. He was formerly executive vice-president of Peterson Machine Tool Inc., Meriam, Kansas, which was recently acquired by Sperry.

continued on page 22

YOU CAN'T ALWAYS WELD BY THE BOOK

Books don't pinpoint all the welding variables. Complex joints. Fussy metals. Tricky fixturing. These variables create problems, more and more of which are being solved by the utilization of *inert-gas* and *consumable-electrode* welding processes . . . combined with pioneering *experience*—the kind you find at Linde Company's Electric Welding Laboratory. Everyone claims "unmatched" research and development facilities. We have 74 fully-equipped *electric welding* stations . . . 100-plus *electric welding* specialists who spend 62% of their time on customers' problems, much of it in customers' plants, all of it free-of-charge. We are spending 3.5 million dollars every year to develop new processes, improve existing ones, and support customer-assistance programs. Here, in the past 25 years, LINDE has developed eleven major inert-gas and consumable-electrode concepts—from *submerged-arc* to *short-arc* —far more than any other manufacturer. The source of these developments—the LINDE Electric Welding Laboratory—is always ready to work for you. And since we market *every type* of inert-gas and consumable-electrode equipment, your problem receives the authoritative, yet impartial study you need.

LINDE COMPANY

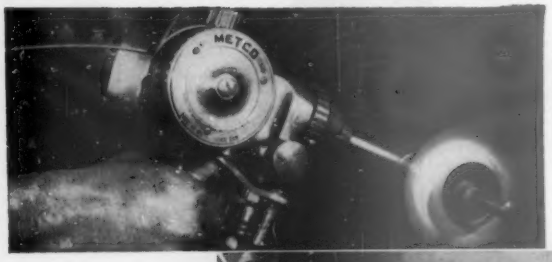
UNION CARBIDE

Division of Union Carbide Corporation
270 Park Avenue, New York 17, N. Y.

"Linde" and "Union Carbide" are registered trade marks of Union Carbide Corporation.

For More Information Circle No. 63 on Reader Service Card.

Complete your shop with this modern metallizing installation



WIRE GUN
Sprays any metal that can be drawn into wire form.

POWDER GUN
Sprays hard-facing alloys and ceramics in powder form.

Without metallizing no maintenance or "job" shop can offer the same complete service as the shop that uses industry's low-cost "putting-on" tool.

With modern, low-cost metallizing equipment you can spray carbon steels, stainless, babbitts, brass, bronze, nickel, aluminum, tin, zinc, special hard facing alloys including tungsten carbide.

- **Save up to 90% of replacement costs on machine repair jobs**
- **Do your own hard-facing at high speed, low cost**
- **Apply long-wearing, corrosion-resistant coatings**

A real opportunity for the smaller shop

Thousands of large, well-known companies and shops have been metallizing users for many years, not only in maintenance work but in production applications on original equipment. Now, with modern low-cost metallizing equipment this high-speed "putting-on" tool is within the reach of even the smallest shop.

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Send off the coupon for detailed information — find out how a metallizing installation can pay for itself in a very short time. No obligation, of course.

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MEN ON THE MOVE

continued from page 20

Blaine G. Harrington has been appointed manager of Air Reduction Sales Company's Kansas City district, it was announced by D. F. McCandlish, midwestern regional sales manager.

The appointment of **John W. Allen** as manager, Engineering, Non-Destructive Testing, Instruments Division of the Budd Co., was announced by Dr. John H. Buck, vice president and general manager of the Instruments Division. Mr. Allen had been in charge of the non-destructive Testing Laboratory at Oak Ridge National Laboratory.

Progressive Welder and Machine Co., Pontiac, Michigan has expanded its national sales organization by opening a west coast office and appointing new eastern reps. Heading the Los Angeles office are **Ron Bever** and **Ron Arkils. Don Campion** will represent the company in Ohio, Western Pennsylvania, and Western New York. **Frank Brainard** and Associates will cover Eastern Pennsylvania and the northeastern seacoast.

Thomson Electric Welder Co., Lynn, Mass., has announced the promotion of **C. Dana Moore, John C. Grant, Jr.,** and **George R. Grant** to executive sales posts. Mr. Moore becomes sales manager, John Grant, assistant sales manager, and George Grant, factory sales engineer.

Ned Nyberg, head of Nyberg Equipment Co., St. Louis, will represent J. B. Nottingham & Co., Inc., in Missouri, western Illinois and northwestern Kentucky.

Simon A. Greenberg, formerly Technical Secretary of the American Welding Society, has opened an office in New York as a consultant in metals joining, manufacturing operations, quality control and other industrial operations.

continued on page 24

32,000 VARIATIONS OF WELDER CONTROL AVAILABLE FROM STOCK!

Square D "Building-Block" Construction means fast delivery of the Control you need

• When you need welder control—for any welding function—Square D can give you what you want, when you want it. More than 32,000 combinations of enclosures and plug-in panels can be made up from off-the-shelf stock to meet your exact requirements. The result—your control is made to order, thoroughly checked and tested, and shipped without delay. Similar facilities exist in warehouses from coast to coast, and warehouse stocks of plug-in panels are also available to assist Square D field engineers in on-the-spot service. • Square D plug-in construction lets you add control functions as you need them. Panels perform all NEMA standard functions, with either tube or relay firing, including heat, slope, current regulator, dual functions, forge and anti-repeat initiation. All NEMA standard enclosures are available, with or without disconnect switch, as well as enclosures to meet JIC specifications or your own special requirements. You can get the welder control you need from Square D—quickly!

Write for details. *For the complete story on Square D welder control, write for Bulletin SM-277. Square D Company, 4041 North Richards Street, Milwaukee 12, Wisconsin*

SQUARE D COMPANY

—wherever electricity is distributed and controlled

For More Information Circle No. 93 on Reader Service Card.

By the Manufacturers of Famous

ATLAS | WIDE-BLADE TOMAHAWKS

WORLDS LEADING WELD CLEANING TOOLS

4 NEW ACCESSORIES

To Make The Welder's Job Easier!

FAST DRAW "SAFETY" HOLSTERS

MODEL 19 HOLDS ANY KIND OF HAMMER

$1.95

Holster made of heavy full grain saddle leather with belt loop adjustable to 5 lengths. For welders, plumbers, carpenters, millwrights.

MODEL 192 DUAL CASE HOLDS TOMAHAWK & 10 LBS. WELDING RODS

A supply of rods and the Atlas Tomahawk of your choice at your side where you can grab them without even looking. This case has a flat bottom and will stand if you choose not to wear it while working. Heavy full grain saddle leather.

$4.75

MODEL 21 FOR CARRYING ANY COMBINATION WELD CLEANING TOOL

Holds Atlas "Dual Tool" or any chipper-brush tool. Protects the welder's fingers and clothing. Prevents brush getting frayed. 5 adjustments on belt loop. Heavy full grain saddle leather.

$3.25

MODEL 15 SAFETY BELT

Heavy webbing with rust proof ring and snap. Wear it over your coveralls as a belt or shoulder strap to carry equipment.

$2.25

Tough as they come!

Atlas makes 33 different weld cleaning tools. There's one for every purpose and preference—Ask your welding supply dealer to show them to you.

ATLAS WELDING ACCESSORIES INCORPORATED
707 E. LEWISTON
FERNDALE 20, MICH.

For More Information Circle No. 21 on Reader Service Card.

MEN ON THE MOVE

continued from page 22

PROMOTIONS:

LANGHENRY *above*

JONES *above, right*

TAYLOR *right*

Erico Products, Inc., Cleveland, has announced the promotion of **Ed Langhenry,** midwestern regional sales manager, to national sales manager for three company divisions: Cadwell Electrical Connection Div., Caddy Arc Welding Accessory Div., and Caddy Toggle Clamp Div.

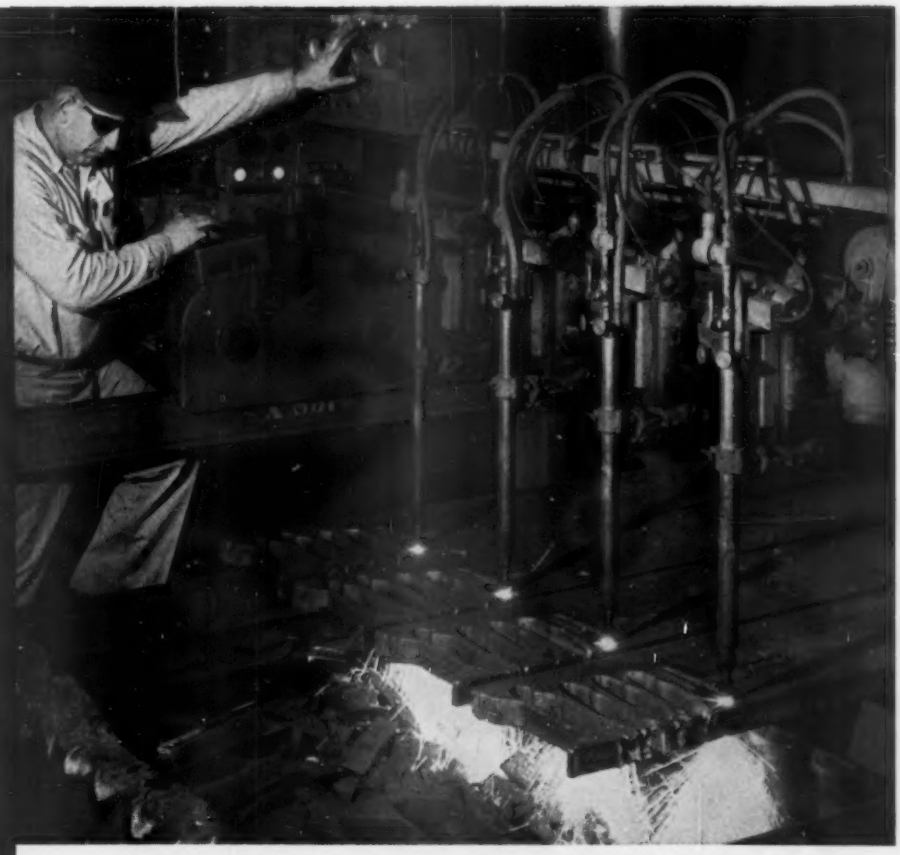
James F. Jones has been named group executive in charge of the A. O. Smith Corporation's Industrial Products Group. This group includes welding products. Jones was previously general manager of the company's Automotive and Railway Products Group.

Also at A. O. Smith, **T. L. Taylor** was named group merchandising manager of the Welding Products Division.

David J. Fullen of the Lincoln Electric Company has been transferred from Philadelphia to the York, Penna. office. He replaces **Gordon T. Collier** who was transferred to Cincinnati.

Lukens Steel Company, Coatesville, Pa., has announced the promotion of **George L. Stroman, Jr.,** to superintendent of the flanging department; of **Charles H. Brown** to manager of research.

DON'T SPEND MONEY— MAKE MONEY... WHEN YOU BUY OXYGEN CUTTING MACHINES



WELDING ENGINEERING Messer SINCE 1898

AMF Estimates Messer Statosec Will Pay For Itself In 18 Months!

Yes, American Machine and Foundry, Brooklyn, has achieved results far beyond expectations from the Messer oxygen cutting machine shown here. This *Statosec* unit turns out dies (for cigar wrappers) at a rate far faster than they were formerly produced.

Cost savings are such that the Messer machine can pay for itself in only 18 months—a factor that can contribute substantially to profits.

Don't spend money, make money by installing Messer machines.
Write for details on the complete Messer line.

Messer Cutting Machines, Inc.

CHRYSLER BUILDING • 405 LEXINGTON AVENUE, NEW YORK 17, N.Y.

For More Information Circle No. 69 on Reader Service Card.

No danger to these welds from hydrogen embrittlement. They're produced with Inco-Weld "A"; carbon steel flanges to stainless steel jacket, stainless steel jacket to Inconel* nickel-chromium alloy plate.

Inconel alloy to stainless steel to carbon steel ...Versatile Inco-Weld "A" Wire joins all 3

This retort is destined for brazing and bright annealing at working temperatures up to 2100°F in dry hydrogen atmosphere.

The welding problem was to obtain joints between three dissimilar metals: Inconel alloy, stainless steel, and carbon steel. These joints had to resist oxidation, resist cracking due to hydrogen embrittlement, and at the same time remain strong at high temperatures.

Rolock, Inc. of Fairfield, Connecticut, produced the desired welds with a *single* material, Inco-Weld "A"* wire. This wire, it has been demonstrated, will produce X-ray quality welds between 97% of all weldable dissimilar alloy combinations. What's more, the Inco-Weld "A" deposit matches (or betters) the heat and corrosion resistance of most parent metals. Other advantages include:

1. High tolerance for dilution of base metals without forming brittle or crack sensitive alloys.
2. Moderate coefficient of expansion.
3. Ability to withstand high service temperatures over long periods of time.

Inco-Weld "A" wire and electrodes are easy to use. No special equipment is required. Arcs are spray-type. Work seldom needs pre-heating.

Both wire and rod are available in standard diameters and forms, and conveniently packaged.

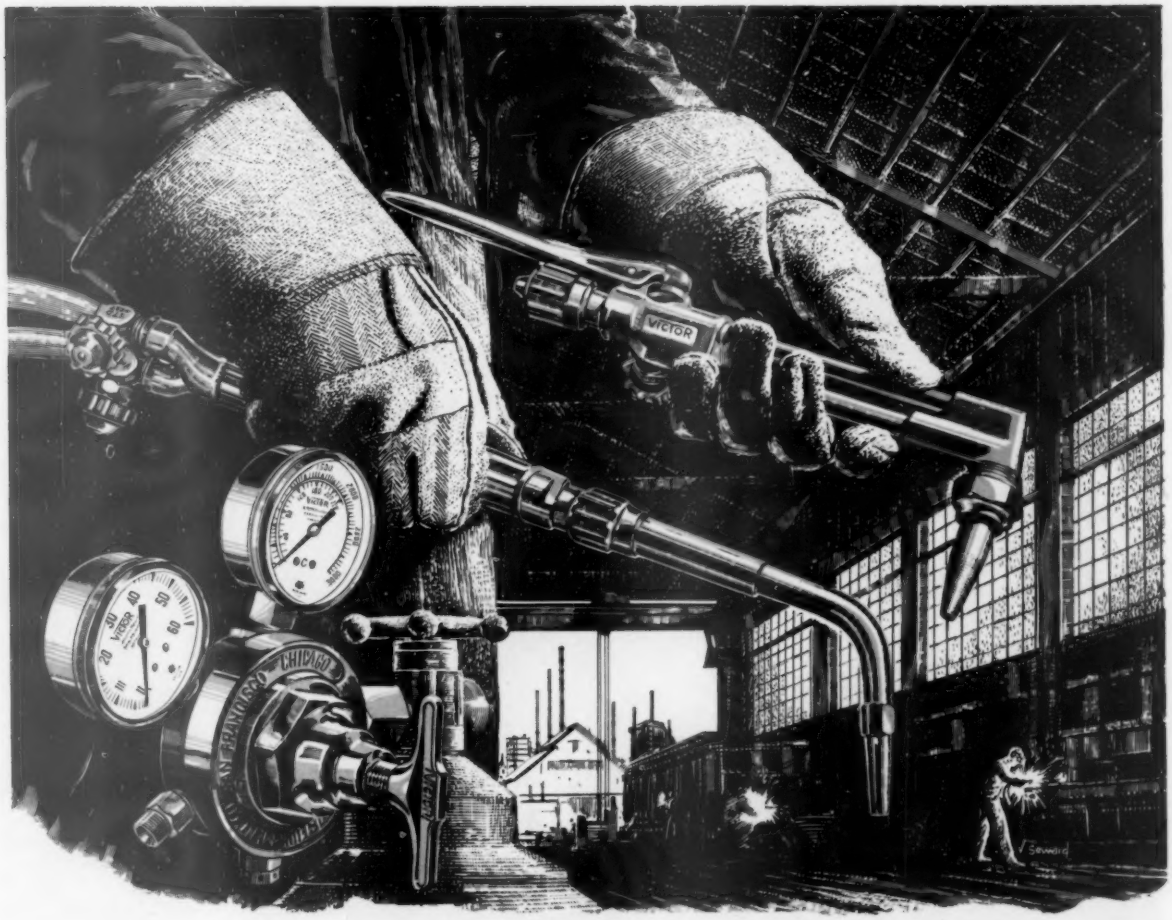
You can get further particulars on the use of Inco-Weld "A" in joining many dissimilar alloy combinations from our folder, "Now You Can Weld Dissimilar Alloys Quickly and Easily." If you don't have a copy, write:

*Inco trademark

HUNTINGTON ALLOY PRODUCTS DIVISION
The International Nickel Company, Inc.
Huntington 17, West Virginia

INCO TRADE MARK **WELDING PRODUCTS**
electrodes · wire · fluxes

For More Information Circle No. 56 on Reader Service Card.



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VICTOR Combination Welding and Cutting Units

VICTOR for welding and cutting

With Victor's wide variety of nozzles, tips, and cutting attachments, and reliable, field-proven regulators, you can handle all your jobs with ease.

See your Victor dealer's complete stock of welding and cutting units for industrial uses . . . or if you're looking for economy, Victor's Super-Range unit (only $99.00, including accessories) is your best buy. Helpful literature yours for the asking. Call your Victor dealer today.

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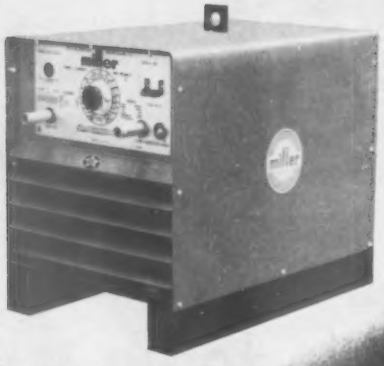
MFRS. OF HIGH PRESSURE AND LARGE VOLUME GAS REGULATORS; WELDING & CUTTING EQUIPMENT; HARDFACING RODS; BLASTING NOZZLES; COBALT & TUNGSTEN CASTINGS; STRAIGHT-LINE AND SHAPE CUTTING MACHINES; ROLLER AND IDLER REBUILDING MACHINES

For More Information Circle No. 101 on Reader Service Card.

TWO NEW COMPACTS from miller

Model M-295 a-c welder



Model H-3-SR d-c welder

Wide range Miller M-295 a-c welder packs a lot of versatility in its compact 25″ x 19″ x 28″ case. What's more, it's a genuinely low-cost 40 volt 200 ampere industrial welder that doesn't pretend to be all things to all men. Rather, it offers typical Miller sturdiness and reliability in a 60% duty cycle machine that's ideal for general maintenance and light production welding. Welding amperage ranges are 25-115 and 80-295. Power factor correction available as option.

SILVER STAR MODEL

Outsized performance has been built into this "inside" welder. Designed expressly to deliver the best in d-c welding at the lowest possible cost, the brand new Miller Silver Star performs on a par with the world's best (Miller's Gold Star SRH) but is less weather-resistant. If your d-c welding is done under a roof, then you'll want to know more about the Miller Silver Star, and the economies it offers. Two sizes available: H-3-SR with amperage ranges of 40-295 and 75-450; and H-4-SR with ratings of 50-350 and 100-600.

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WELDING MANAGEMENT

watches these developments

FOR THE FIRST TIME welding positioning equipment is now available on a rental basis. Paul Galton, general manager of the Ransome Company, Scotch Plains, N. J., recently announced that all the standard models and many special models of the company's positioners, manipulators, turning rolls, and head and tail stocks, may now be rented directly from the company for any desired period. Besides obvious advantages, Mr. Galton explains that rental fees may be considered an equipment cost for a particular job and are deductible in toto; purchased equipment is a capital expense and only write-off available comes through depreciation.

A PROGRAM FOR MARKETING a new family of high strength, heat-treated steels through a nationwide network of independent steel service centers is announced by Great Lakes Steel, Detroit, division of National Steel Corp. This is the first time Great Lakes Steel products have ever been available for national distribution through warehouse outlets. Available is a wide choice of constructional grades in strength levels up to 110,000 psi or abrasion-resistant grades up to 550 Brinnell hardness.

LETTERS FROM IKE, RICHARD NIXON, and other prominent government officials and businessmen are featured in the August-September issue of MEMCO NEWS published by the Miller Electric Mfg. Company. The letters are in reply to an article on the confiscatory nature of our nation's taxation system that appeared in MEMCO NEWS for April-May. Copies of the August-September issue can be had by writing to Niels C. Miller, president, at Appleton, Wisconsin.

IN RUSSIA, organic resins are replacing water glass as the bonding agent in a new type of electrode coating. A Russian publication reports that the new coating has the same protective ability even though it is lighter and thinner than conventional coatings. Its curing temperature is only 150°C; it is not hygroscopic. Reports are that the new coating simplifies the electrode manufacturing process.

A NEW AND HIGHER YIELD POINT structural carbon steel is now available from United States Steel Corp. The new steel conforms to specification A36-60T for rolled structural steel recently approved by ASTM. It has a higher minimum yield point than the two other specifications for structural carbon steel that have long been considered standard in the heavy construction field: ASTM A7 and ASTM A373. The steel promises average savings of four to six percent in the weight of steel structures.

IN BELGIUM, two leading plate fabricating concerns are joining with Union Tank Car Company's Graver Tank & Manufacturing Division. The new company, Compagnie Graver, S. A., will offer the European Common Market the full line of conservation equipment and other products developed by Graver, which has been a leader in the design, fabrication, and erection if tanks, pressure vessels, and steel plate.

WELDING SUPPLY SALES were up 5 percent for the second quarter over the same period in 1959, according to the National Welding Supply Association. The Association found that sales were up 7 percent for the first six months of 1960 compared with the same period in 1959. Figures are based on the reports of 201 NWSA distributor members.

EXCELLENT BUSINESS DURING JULY was reported by the Resistance Welder Manufacturers' Association. Business during that month climbed well over the $3 million mark. The new business represented a 47 percent increase over June. For the first seven months of 1960, new business and shipments were ahead of 1959 (14% and 21%, respectively).

A NEW PACKAGE DESIGN has been adopted by Certanium Alloys and Research Corp. The packages carry the new trademark used on all company stationary. This bold trademark becomes part of the strong package image through the use of powerful color combinations wedded with strong industrial-looking type faces. The red-hot orange and white of the new packages convey the feeling of the intense welding heat; large solid black areas give the consumer a sense of strength and durability.

ELECTRON BEAM WELDING of molybdenum and tungsten will be studied for the U. S. Air Force by Hamilton Standard, a division of United Aircraft Corp., which markets in this country electron beam welding and cutting equipment developed by the Carl Zeiss Foundation of West Germany. Hamilton Standard will test butt, lap, seam, edge, and spot welds in tungsten and molybdenum ranging in thickness from 0.005 to 0.1 inches.

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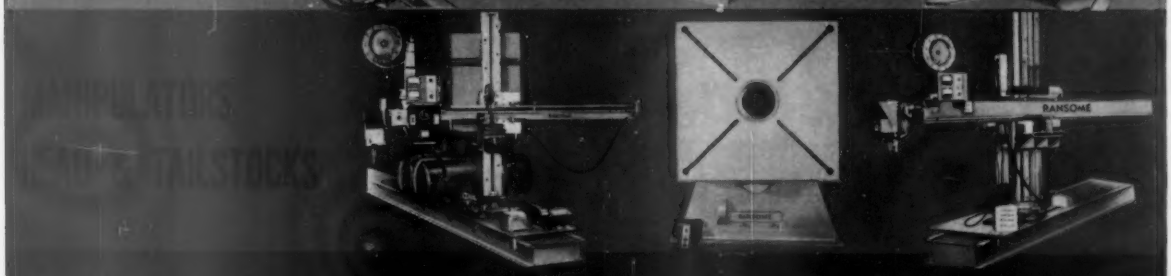

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no capital outlay is required to give you immediate use of fine, rugged Ransome positioners, manipulators, turning rolls, head and tailstocks . . . furthermore, you can write off the entire rental you pay for this equipment—no need to rely on depreciation rates.

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the savings introduced through the use of new and modern positioning equipment on most jobs will far exceed the low rental cost.

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equipment that you rent need never sit idle, wasting space, adding overhead. The day you're finished with it, ship it back to us!

YOU CAN RENT a $2000 positioner and start to make profits immediately... for as little as $1.25 per hour... without capital outlay!

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RANSOME COMPANY, Scotch Plains, New Jersey

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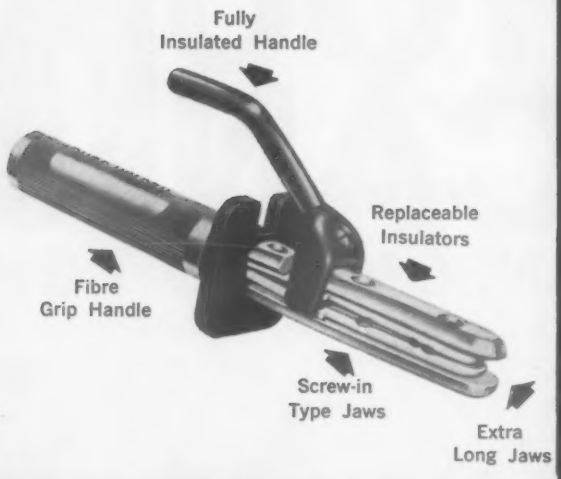

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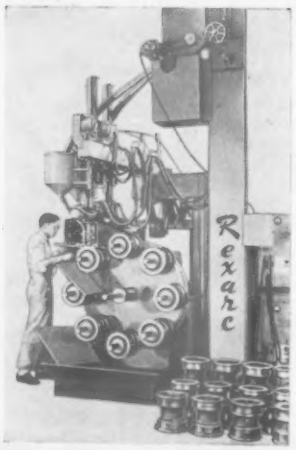

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Want to weld atop a tank, on a mast or a derrick – without carrying around a pallet-full of equipment? The all-new MIGet Gun lets you weld in such out-of-the-way spots, with Aircomatic quality. It's a metal arc gas shielded tool that's perfect for such jobs, or for making numerous short welds – in aluminum, stainless, mild steel, etc. – at remarkably low cost.

Airco also produces a complete line of manual and automatic gas shielded arc welding equipment – Heliwelding for light and medium gauges, Aircomatic for heavier gauges and for cutting . . . and also everything you need in gas welding and cutting equipment, industrial gases, arc welders. Call your nearest Airco office or Authorized Airco Distributor. Look in your Classified Telephone Directory under "Welding Equipment and Supplies" for your nearest Airco representative.

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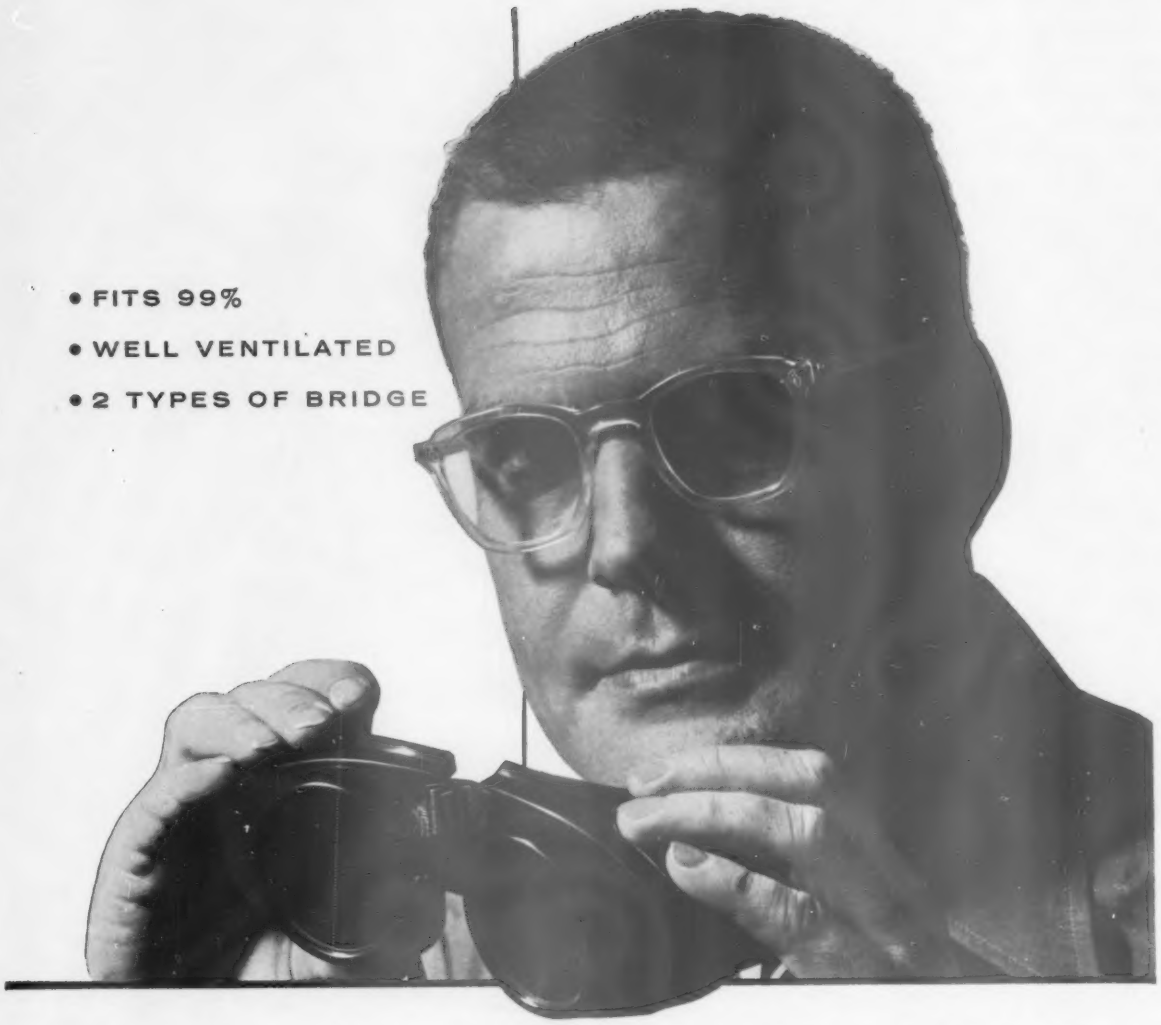

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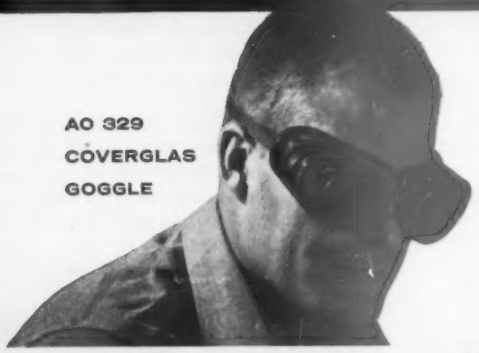

QUICK FACTS

- Accommodates every type of personal glasses.
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Silvaloy offers the most advanced flux developments in this specialized field. Here, is *a complete line of fluxes* . . . each providing outstanding performance, enabling you to select the correct flux for every possible low temperature brazing operation. The extra efficiency of Silvaloy "Selective Fluxing" is being proved daily on the brazing production lines of the country's leading manufacturers.

Call the Silvaloy distributor in your area for consultation and detailed information or, send for our booklet "A Complete Guide to Selective Fluxing for Low Temperature Silver Brazing."

Silvaloy fluxes are packaged in 65-lb. and 30-lb. drums, 5-lb. wide mouth jars (5 to a carton), 1-lb. and ½-lb. jars. The wide opening of the 5-lb. package makes it a most practical, time saving dispenser that also enables the operator to make use of every bit of flux in the jar.

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For More Information Circle No. 11 on Reader Service Card.

to do the job better and cheaper

WELDING AT WORK

Mobile X-ray unit checks welds in B-70 assemblies

LOS ANGELES: A unique "in-tooling" X-ray technique provides a high degree of reliability while helping speed production and inspection of large welded honeycomb assemblies for the B-70 intercontinental bomber. The technique, developed at North American Aviation's Los Angeles Division, permits radiographic detection of defects in fusion welds. It utilizes a narrow X-ray beam which is moved along a weld, exposing a strip of radiographic film placed behind the weld.

The mobile "in-tooling" unit is unique in that an entire welded asembly can be left in its working jig while inspections are being made. Work can continue on other portions with no danger to workers.

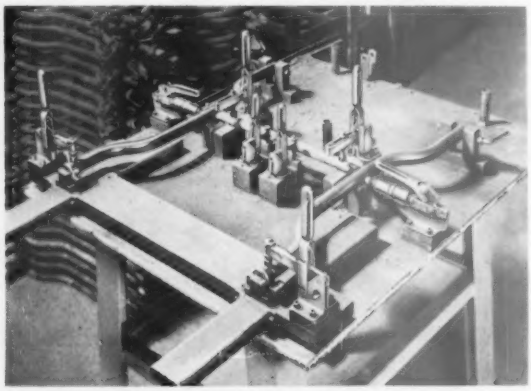
Most X-ray inspection methods require large, carefully shielded rooms to protect workers against excessive radiations. Big assemblies must be taken from working jigs and moved to these rooms for inspection.

Safety devices incorporated in the mobile unit were developed in cooperation with the company's safety engineers.

Adjustable welding fixture holds different length legs

DETROIT: An adjustable welding fixture used by Schieber Mfg. Co., suppliers of folding tables and benches to the institutional market, reduced tooling costs for making folding-table legs. The new design eliminated the need for having separate fixtures for legs of different length.

Key to the design of the fixture is an integrally built H-frame, with end-stops and two De-Sta-Co Series 210 clamps, that slides on ways to suit any length leg required. Detroit Stamping Co. furnished the clamps.



The assembly operation starts by locating a hinge-pin (which has already been welded to a cross-bar) in V-blocks. The cross-bar, with slightly flattened ends, rests on support blocks. Side members of the assembly (the legs) are located from holes drilled near their ends during prior fabrication. The H-frame is then pushed against the opposite ends of the legs to provide a snug fit against end-stops. The legs are locked in position by the Series 210 clamps on the H-frame.

To get rigid construction, the cross-bar and legs must be welded together with a solid weld. This requires a tight fit for the side members against the cross-bar before welding. Two De-Sta-Co Model 610 plunger-type clamps, positioned in line with the cross-bar, are used to lock the cross-bar and side-members together.

When parts have been positioned, two more Series 210 clamps are used to clamp the cross-bar firmly against the support blocks. Also, two Series 207 toggle clamps are used to lock the attached cross-bar hinge-pin in the V-blocks. The assembly is then welded into a single, rigid unit.

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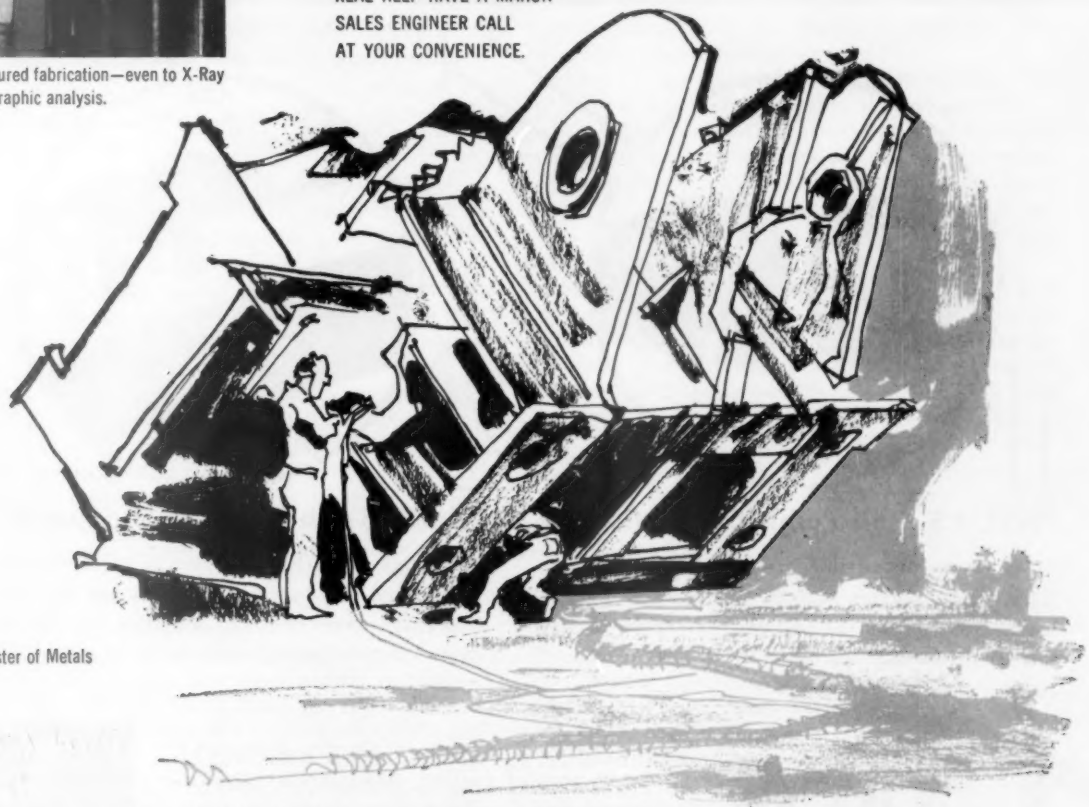

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M A H O N

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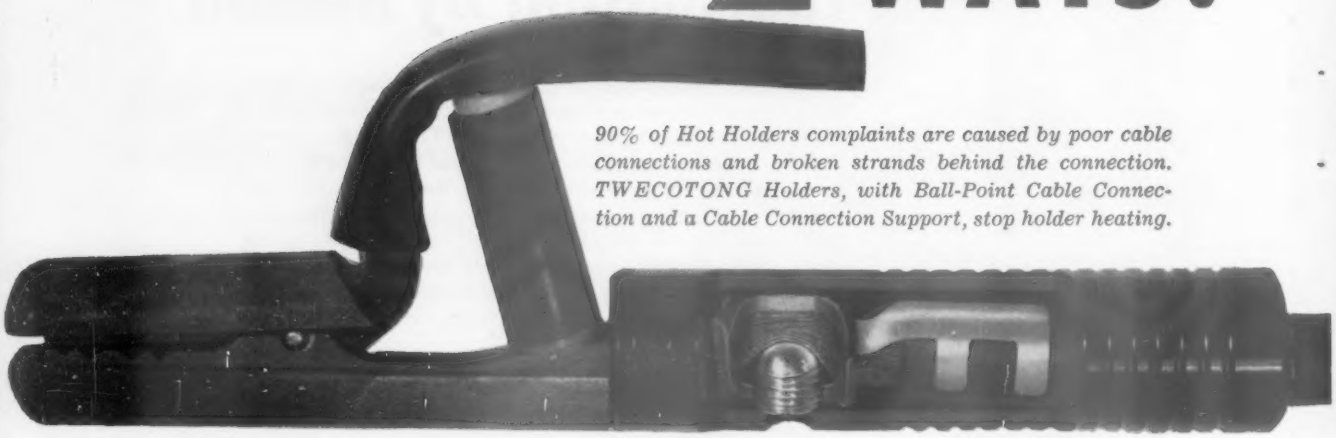
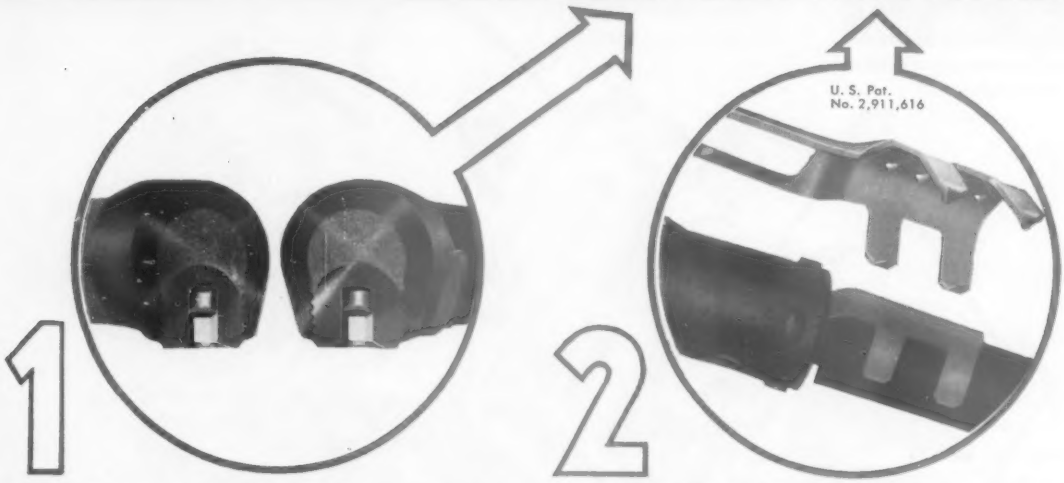


90% of Hot Holders complaints are caused by poor cable connections and broken strands behind the connection. TWECOTONG Holders, with Ball-Point Cable Connection and a Cable Connection Support, stop holder heating.



TWECO'S Ball-Point Connection

holds every strand under extreme pressure. Each strand carries current. Does not work loose. Holder can be installed on cable in less than two minutes using 7/32" hex wrench. Saves time – Saves money.

TWECO'S Cable Connection Support

absolutely stops the movement of cable strands behind the cable connection. Strands can not break and cause heating. Also stops the cable jacket from slipping, exposing bare strands.

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OCTOBER, 1960
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the world's lightest structural metal is showing up in more and more products. So you won't be left behind, here are . . .

The Newest Ways To Cut And Join Magnesium

by **T. L. PATTON,** *The Dow Metal Products Company*

IN BRIEF: Significant new processes for joining magnesium alloys to each other and to aluminum alloys have been developed. Some are on the production line, others are ready for it, still others show great promise for future production use.

METAL INERT GAS (consumable electrode) welding is the most important development for joining magnesium alloys to each other and to other alloys. Our company, other magnesium fabricators, and companies working with magnesium have been prominent in this and other developments for joining this versatile metal.

Metal inert gas welding (see tables on page 41) is used in the fabrication of materials handling equipment and military hardware ranging from tanks to missile airframes. This process is three to five times faster than tungsten arc welding. It welds 5/8-inch plate in one pass at 30 ipm, 1/4-inch plate at 50 ipm. The narrow heat-affected zone obtained at these speeds gives stronger welds, nearly 100 percent efficient, compared to the tensile strength of the parent metal. There also is less distortion.

Lack of proper magnesium welding electrodes and equipment for feeding magnesium wire at the proper speeds and currents has delayed the broad use of metal inert gas welding. Now that we have them the process is ready for even thin materials.

The best welding conditions for metal inert gas welding are obtained with argon gas or mixtures of argon and helium. Helium by itself is unsatisfactory because of metal spatter and turbulence.

Wire drive units of the pull type with V-grooved nylon drive rolls are recommended for magnesium. Some think serrated drive rolls are the best because they grip better and expose clean metal for good current pick up. The newest contact tubes seem to give better pick up than the straight tubular type even though the electrode filler wire oxidizes.

However, for best results, the electrode filler wire should be clean before it enters the contact tube.

A constant potential d.c. reverse polarity (electrode positive) power source with a rising or flat output characteristic is preferred to the conventional power source. It rapidly adjusts to variations in arc length. This power source also greatly reduces burnbacks which fuse the electrode to the contact tube.

Although metal inert gas welding of magnesium is new and needs further development, the process has already cut costs in many applications. One of the problems of metal inert gas welding is start and stop cracks. Cracks are avoided by manipulating the welding torch, but for some welds more refined equipment may be necessary. Cold starting cracks or crater cracks must be ground or chipped out and rewelded. Starting or stopping tabs are an easy way to eliminate cracks.

STUD WELDING

While magnesium has not been stud welded extensively, the results of welds made have been encouraging. (See table page 41) Typical of successful joints is a 1/2-inch AZ31B stud welded to a 1/4-inch AZ31B plate. Some welds using 3/4-inch and 1-inch studs have been made.

Typical welding conditions for magnesium stud welding are 10-15 cfh argon, 200 amps d.c. reverse polarity and 80 to 120 cycles current.

ARC CUTTING

Another new development is a process for cutting thick magnesium plates. The principles and equipment used are similar to tungsten arc welding. A constricted nozzle, a pilot arc, and a mixture of 35 per-

continued on page 41

RECOMMENDED FILLER ALLOY FOR MAGNESIUM-ALLOY JOINTS

By Inert Gas Shielded Arc Welding Processes

BASE ALLOY ↓ / FILLER ALLOY →	A3A	AM100A	AZ31B&C	AZ61A	AZ63A	AZ80A	AZ81A	AZ91C	AZ92A	EK30A	EK41A	EZ33A	HK31A	HM21A	HM31A	HZ32A	K1A	M1A MG1	QE22A	ZE10A	ZE41A	ZH62A	ZK21A	ZK51A	ZK60A&B
A3A	1. AZ92A 2. AZ61A																								
AM100A	1. AZ92A 2. AZ61A																								
AZ31B&C	1. AZ92A 2. AZ61A		1. AZ92A 2. AZ61A																						
AZ61A	1. AZ92A 2. AZ61A		1. AZ92A 2. AZ61A	1. AZ92A 2. AZ61A																					
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AZ80A	1. AZ92A 2. AZ61A		1. AZ92A 2. AZ61A	1. AZ92A 2. AZ61A	X	1. AZ92A 2. AZ61A																			
AZ81A	1. AZ92A 2. AZ61A		1. AZ92A 2. AZ61A	1. AZ92A 2. AZ61A	X	1. AZ92A 2. AZ61A	1. AZ92A 2. AZ61A																		
AZ91C	1. AZ92A 2. AZ61A		1. AZ92A 2. AZ61A	1. AZ92A 2. AZ61A	X	1. AZ92A 2. AZ61A	1. AZ92A 2. AZ61A	1. AZ92A 2. AZ61A																	
AZ92A	X		X	X	X	X	X	AZ92A	AZ92A																
EK30A	1. AZ92A 2. AZ61A		1. AZ92A 2. AZ61A	1. AZ92A 2. AZ61A	X	1. AZ92A 2. AZ61A	1. AZ92A 2. AZ61A	1. AZ92A 2. AZ61A	X	EZ33A															
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HK31A	1. AZ92A 2. AZ61A		1. AZ92A 2. AZ61A	1. AZ92A 2. AZ61A	X	1. AZ92A 2. AZ61A	1. AZ92A 2. AZ61A	1. AZ92A 2. AZ61A	1. AZ92A 2. AZ61A	EZ33A	EZ33A	EZ33A	EZ33A												
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HM31A	1. AZ92A 2. AZ61A		1. AZ92A 2. AZ61A	1. AZ92A 2. AZ61A	X	1. AZ92A 2. AZ61A	1. AZ92A 2. AZ61A	1. AZ92A 2. AZ61A	1. AZ92A 2. AZ61A	EZ33A	EZ33A	EZ33A	EZ33A	EZ33A *HM31A	EZ33A *HM31A										
HZ32A	1. AZ92A 2. AZ61A		1. AZ92A 2. AZ61A	1. AZ92A 2. AZ61A	X	1. AZ92A 2. AZ61A	1. AZ92A 2. AZ61A	1. AZ92A 2. AZ61A	X	EZ33A	EZ33A	EZ33A	EZ33A	EZ33A	EZ33A	EZ33A									
K1A	**		**	**	X	**	**	**	X	EZ33A	EZ33A	EZ33A	EZ33A	EZ33A	EZ33A	EZ33A	EZ33A								
M1A MG1	1. AZ92A 2. AZ61A		1. AZ92A 2. AZ61A	X	X	X	X	X	X	EZ33A	EZ33A	EZ33A	1. AZ92A 2. AZ61A 3. EZ33A	1. AZ92A 2. AZ61A 3. EZ33A	1. AZ92A 2. AZ61A 3. EZ33A	1. AZ92A 2. AZ61A 3. EZ33A	EZ33A	1. M1A 2. AZ92A 3. AZ61A 4. EZ33A							
QE22A	X	X	X	X	X	X	X	X	X	EZ33A	EZ33A	EZ33A	EZ33A	EZ33A	EZ33A	EZ33A	EZ33A	EZ33A	EZ33A	EZ33A						
ZE10A	1. AZ92A 2. AZ61A		1. AZ92A 2. AZ61A	1. AZ92A 2. AZ61A	X	1. AZ92A 2. AZ61A	1. AZ92A 2. AZ61A	1. AZ92A 2. AZ61A	X	1. AZ92A 2. AZ61A 3. EZ33A	1. AZ92A 2. AZ61A 3. EZ33A	1. AZ92A 2. AZ61A 3. EZ33A	1. AZ92A 2. AZ61A 3. EZ33A	1. AZ92A 2. AZ61A 3. EZ33A	1. AZ92A 2. AZ61A 3. EZ33A	1. AZ92A 2. AZ61A 3. EZ33A	1. AZ92A 2. AZ61A 3. EZ33A	1. AZ92A 2. AZ61A 3. EZ33A	EZ33A	1. AZ92A 2. AZ61A 3. EZ33A					
ZE41A	X	X	X	X	X	X	X	X	X	EZ33A	EZ33A	EZ33A	EZ33A	EZ33A	EZ33A	EZ33A	EZ33A	EZ33A	EZ33A	EZ33A	EZ33A	EZ33A				
ZH62A	X		⊙AZ92A ⊕AZ61A	⊙AZ92A ⊕AZ61A	X	⊙AZ92A ⊕AZ61A	⊙AZ92A ⊕AZ61A	⊙AZ92A ⊕AZ61A	X	○EZ33A	○EZ33A	○EZ33A	○EZ33A	○EZ33A	○EZ33A	○EZ33A	○EZ33A	X	○EZ33A	⊙ AZ92A ⊕ AZ61A ⊙ EZ33A	EZ33A	EZ33A			
ZK21A	1. AZ92A 2. AZ61A		1. AZ92A 2. AZ61A	1. AZ92A 2. AZ61A	X	1. AZ92A 2. AZ61A	1. AZ92A 2. AZ61A	1. AZ92A 2. AZ61A	X	1. AZ92A 2. AZ61A 3. EZ33A	1. AZ92A 2. AZ61A 3. EZ33A	1. AZ92A 2. AZ61A 3. EZ33A	1. AZ92A 3. AZ61A 3. EZ33A	1. AZ92A 2. AZ61A 3. EZ33A	1. AZ92A 2. AZ61A 3. EZ33A	1. AZ92A 2. AZ61A 3. EZ33A	1. AZ92A 2. AZ61A 3. EZ33A	1. AZ92A 2. AZ61A 3. EZ33A	EZ33A	1. AZ92A 2. AZ61A 3. EZ33A	EZ33A	X	1. AZ92A 2. AZ61A 3. EZ33A		
ZK51A	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
ZK60A&B	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

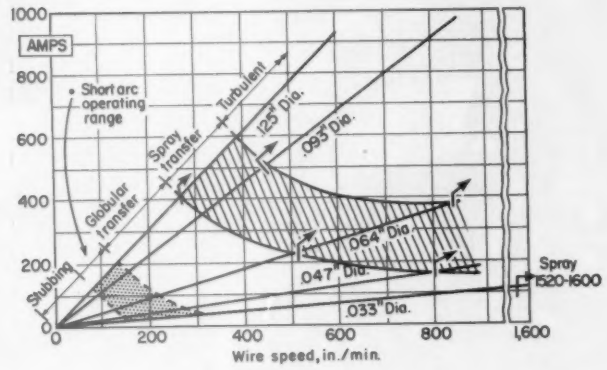
ALLOY	CODE COLOR	SIZE—DIA. (Inches)	FORM	LOTS
M1A	Yellow	1/16; 3/32; 1/8; 5/32; 3/16	36" long Rods, Level & Random Wound Coils	1 Lb. & 5 Lb. Cardboard Tubes, 50 Lb. Cartons, 7 Lb. Coils
AZ61A	Grey	1/16; 3/32; 1/8; 5/32; 3/16	36" long Rods, Level & Random Wound Coils	1 Lb. & 5 Lb. Cardboard Tubes, 50 Lb. Cartons, 7 Lb. Coils
AZ92A	Orange	1/16; 3/32; 1/8; 5/32; 3/16	36" long Rods, Level & Random Wound Coils	1 Lb. & 5 Lb. Cardboard Tubes, 50 Lb. Cartons, 7 Lb. Coils
AZ63A	Green	1/8; 5/32 only	36" long Rods, Level & Random Wound Coils	1 Lb. & 5 Lb. Cardboard Tubes, 50 Lb. Cartons, 7 Lb. Coils
HK31A	Gold	1/16; 1/8; 3/16	36" long Rods, Level & Random Wound Coils	1 Lb. & 5 Lb. Cardboard Tubes, 50 Lb. Cartons, 7 Lb. Coils
EZ33A	Pink	1/16; 1/8; 3/16	36" long Rods, Level & Random Wound Coils	1 Lb. & 5 Lb. Cardboard Tubes, 50 Lb. Cartons, 7 Lb. Coils

NOTE: Other Alloys and Forms Subject of Special Inquiry.

NOTES

1. X = Welding not recommended.
2. Where more than one filler alloy are listed, they are given in order of preference. The No. 1 alloy was chosen for best weldability or maximum strength, or both.
3. Generally speaking, only two filler alloys would be required for most fabrication shops doing magnesium welding. They are:
   (1) AZ92A for the Aluminum-Zinc series of alloys;
   (2) EZ33A for the Magnesium-Thorium and Magnesium-Rare Earth series of alloys.
4. AZ61A filler alloy is used for welding the Aluminum-Zinc series of alloys when cost is the prime factor.
5. *When welding the Magnesium-Thorium series of alloys, use HM31A filler alloy when resistance to creep above 600°F is the prime factor.
6. In emergency, most alloys may be welded with strips cut from the parent metal.
7. ** = No experience in welding K1A alloy to other alloys shown. AZ92A filler alloy probably satisfactory.
8. ○ = No experience in welding ZH62A alloy to other alloys shown. Rods circled probably satisfactory.

IN CONSUMABLE WELDING there are three different types of metal transfer: Short arc transfer for welding up through ⅛ inch thick material; the spray arc transfer for thicker gages; and an intermediate globular arc transfer that's too wild for good welding. Asterisk (*) means limited data.



MACHINE SETTINGS FOR METAL INERT GAS WELDING MAGNESIUM WITH AZ61A ALLOY FILLER WIRE

SHORT-ARC TRANSFER (Argon Shielding)

Sheet Gauge	Wire Diam. in.	Wire Speed Range (in./min.)	Arc Volts	Arc Amps	Remarks
.025	.040	90–250	14.0–17.1	22–40	Snap transfer
.040		145–310	14.2–17.1	22–60	Snap transfer
.063		145–412	14.0–16.3	31–90	Snap transfer
.090		145–380	15.0–16.8	37–83	Snap transfer
.125		240–412	15.5–17.1	50–85	Snap & globular transfer
.025	.063	Not useful—burned through			---------
.040		Not useful—burned through			---------
.063		95–165	14.8–16.8	46–70	Snap transfer
.090		120–220	14.7–17.1	48–93	Snap transfer
.125		120–262	14.9–17.6	55–120	Snap, occasional globular
.090	.093	Not useful—burned through			---------
.125		80–145	15.0–17.0	95–140	Snap transfer
.188		115–205	14.4–17.7	110–195	Snap transfer

TENSION TEST RESULTS OF MAGNESIUM STUD WELDS

Materials: Stud	Materials: Plate	Breaking Load, Lbs.	Stress, PSI	Location of Fracture
1/2" DIA. AZ31B	1/4" AZ31B	3,600	18,200	STUD
		5,200	25,600	STUD
		3,640	18,600	STUD
1/2" DIA. ZK60A	1/4" AZ31B	3,220	16,600	PLATE-WELD JUNCTION
		3,400	17,300	PLATE-WELD JUNCTION
1/2" DIA. AZ31B	1/4" HK31A	3,720	19,000	STUD
		3,400	17,400	STUD-CRACK
		3,800	19,400	STUD-CRACK

cent hydrogen and 65 percent argon produce a hot (28,000 F), high velocity arc that melts the metal. The cut is ⅛-inch wide.

The inert arc cutting process is also used to cut aluminum, copper, stainless steel and other metals. You can cut magnesium twice as fast as aluminum, seven times faster than steel.

Typical speeds for inert arc cutting: 300 ipm for ¼-inch plate with 400 amps, 80 volts and 70 cfh gas flow; and 50 ipm for 2-inch plate with 600 amps, 90 volts and 100 cfh gas flow. Estimates using higher currents raise speeds to 1,500 ipm for ¼-inch plate and 120 ipm for 2-inch plate.

In arc cutting, large volumes of fumes must be removed for the protection and comfort of the operator. The only solution is a big capacity, properly directed exhaust system. This will remove all fumes.

FLUX-DIP BRAZING

You can braze magnesium alloys AZ31B, ZE10A, K1A, and AZ10XA best with the flux-dip process. The reason: Fast heating and plentiful flux provides excellent flow of the brazing metal. No process has been developed for brazing the magnesium-thorium and magnesium-zinc-zirconium alloys.

One manufacturer uses AZ125XA filler alloy for production flux-dip brazing of waveguides. So far there are no rigid specifications for flux-dip filler alloys; it would help us to learn of the requirements of other prospective users of this process.

PRESSURE WELDING

Hot pressure welding of magnesium alloys—to each other and to certain aluminum alloys—has been done successfully on a limited scale. In pressure welding (sometimes called forge welding), surfaces to be welded are pressed together in heated dies. Pressure welds in ZK60A-T5 magnesium are strong: 50,000 psi, efficiencies over 98 percent, and elongation to 12 percent.

FLASH WELDING

Flash welding is a form of resistance welding. An arc is struck between the surfaces to be welded until they become plastic. At this point the process is about the same as forging; forcing the two surfaces together to form a weld. A limited amount of magnesium alloys have been flash welded. • •

Acknowledgments: The author and his company acknowledge the contributions of the following companies and agencies to the development of the processes described in this article: **METAL INERT GAS WELDING:** Army Ballistic Missile Agency, ACF Industries, Inc., Air Reduction Co., Inc., Avco Corp., Copperloy Corp., General Electric Co., Linde Co. (Division of Union Carbide Corp.), Westinghouse Electric Corp. **STUD WELDING:** Avco Corp., Graham Manufacturing Corp., KSM Products, Inc., Nelson Stud Welding Co. **ARC CUTTING:** Linde Co. (Division of Union Carbide Corp.), **FLUX-DIP BRAZING:** Benson Manufacturing Co., Bogart Manufacturing Co., Dalmo Victor Co. (Division of Textron, Inc.), R. O. Roberts Co. **PRESSURE WELDING:** Kelsey-Hayes Co., Ravens-Metal Products, Inc. **FLASH WELDING:** American Welding and Manufacturing Co., National Electric Welding Co., Thomson Electric Welder Co.

SIX-INCH THICK CLAD PLATE is tested ultrasonically after being formed into half segments. The segments were formed at Lukens Steel Co. from clad plate using Type 304L stainless-clad with A-302 (manganese-molybdenum) backing. They became part of the pressure vessel for the Dresden Nuclear Power Station.

Techniques For Fabricating And Welding Clad Steels Thicker Than 2-Inches

by **ALBERT HOERSCH, JR.**, *technical service engineer, Lukens Steel Co.*

IN BRIEF: Heavy clad steels are as easy to fabricate and weld as their thinner gage cousins if you take into consideration certain slight differences in techniques.

CLAD STEELS THICKER than 2-inches have become an engineering necessity. They are being used more and more in the petroleum and chemical industries, and in the burgeoning nuclear power field. Designers use the thick clad steels in the process industries where temperatures and pressures keep getting higher and corrosion more and more severe.

Our research shows that heavy clad steel is as easy to fabricate as its thinner gage cousins. You need take into consideration only slight differences in techniques.

One big difference is the heat treatment required for certain backing steels. For instance, heavy gage steel plates are given a normalizing heat treatment of 1650°F to 1750°F to get the proper metallurgical properties.

Sometimes the heat treatment may be done during hot forming. Heavy gage sections are usually formed hot, although they may be formed cold. In either case, there is usually some heating during fabrication.

This hot forming and heat treating influence the choice of cladding materials.

When you cannot rollform heavy plates cold, you must heat them (often several times) to 1650° to 1800°F. Even when fabricators have presses heavy enough to coldform heavy gage plates by pressing, they often partially form the plate in steps with interstage stress relief heat treatment.

Examples include half shells and head segments for heavy gage pressure vessels. Heavy gage weld-

CLAD STEEL petroleum reactor at Socony Mobil plant was fabricated from 3 1/8-inch thick plates of Type 321 stainless-clad with A-204 (carbon molybdenum) backing.

ments also may be stress relieved at about 1100°F one or more times during welding.

The low carbon grade or stabilized grades of stainless-clad steels, such as Types 304L and 316L or Types 321 and 347, should be used to prevent formation of harmful carbides. The Dresden Nuclear Power Station used Type 304L stainless-clad. Six-inch segments of hot-formed plate became part of the Station's pressure vessel.

Backing steels, such as carbon-molybdenum (A-204) and chrome-molybdenum (A-387) are appropriate where strength at high temperatures and resistance to graphitization are required. Example: Socony Mobil's petroleum reactor at Paulsboro, N.J., is of Type 321 stainless-clad with A-204 backing.

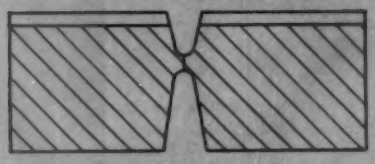
Manganese-molybdenum (A-302) may be chosen for reduced gage or weight saving in high pressure applications. The Dresden reactor exemplifies this idea also. Type 304L stainless-clad with A-302 backing was used because it will hold high pressure.

WELDED JOINTS AND WELDING PROCESSES

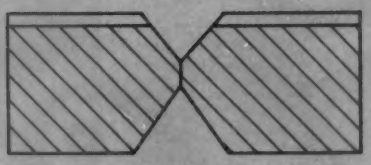
The double-U bevel and double-V bevel are most widely used in welding heavy gage material. Variations depend on whether the edge is machined or flame cut. If the chamfers are straight (as they are in flame cutting) it may be necessary to use a space bar

continued on page 74

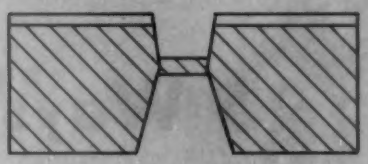
USE THESE JOINTS FOR WELDING CLAD STEEL THICKER THAN 2"



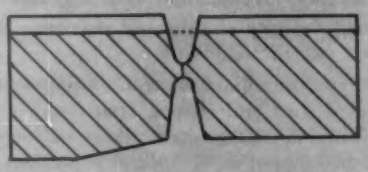
DOUBLE-U BEVEL



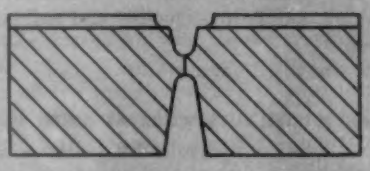
DOUBLE-V BEVEL



DOUBLE-V WITH SPACER BAR



JOINT WITH FOUR-TO-ONE TAPER



STRIP-BACK JOINT

HYDRAULIC LIFT lowers a whole section of floor in front of the spotwelder to put the work at the right height and give greater floor-to-horn clearance for large aluminum cabinets that could not have been welded before.

5 Ways You Can Improve The

IN BRIEF: Westinghouse's Electronics Division uses flexible tooling and careful planning to spot weld electronic equipment that meets rigid military specifications and tolerances on a wide variety of sizes and shapes.

WE SPOTWELD military electronic equipment in a wide variety of sizes and shapes, from small chassis with many intricate weldments to large cabinets and consoles fabricated of sheet stock or extrusions with sheet metal covers. About 90 percent of our work is done in 1/8-inch aluminum; the rest varies from 0.032 to .250 inches.

All our work must meet rigid military specifications and tolerances. To do this economically we had to develop multipurpose tooling and well-planned procedures.

Here are five things we did:

HYDRAULIC LIFT PUTS WORK AT RIGHT HEIGHT

We installed a hydraulic lift platform in a pit in front of one of our spotwelders. Lowering the platform below floor level gives us greater clearance between the lower horn and the floor. This makes it easier to position work at the most convenient working height. And, it makes it easier for us to weld large cabinets. We used to hold these on top of the lower arm and balance them in position for welding, if we could. Now we hang the cabinets over the lower arm.

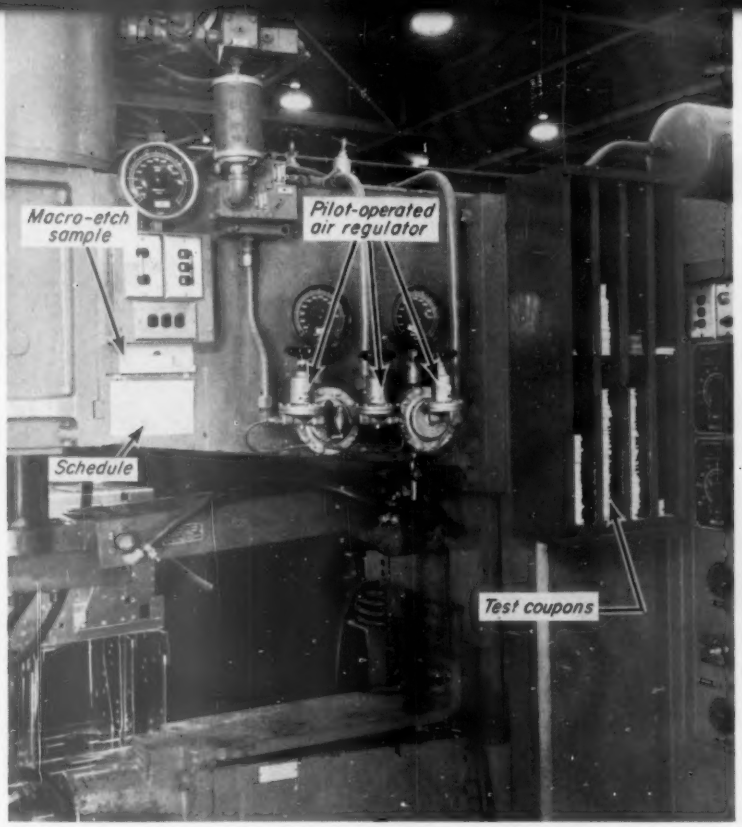
One man instead of two can now handle some cabinets. And, we can now design certain cabinets in ways we could not have spotwelded without the hydraulic lift platform.

UNIQUE ARM AND OFFSET HOLDER

Spot welding thick gages of aluminum demands relatively high pressures to get quality welds. These pressures caused the heavy-duty offset-type electrodes holders we were using to deflect. This changed the location of the spot welding electrode, allowed the pieces to slip, and ruined our close tolerances.

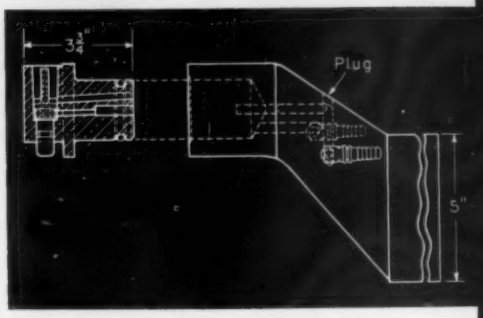
So, we designed a special arm that combined the arm and the offset holder in one. This eliminated the joints and small diameter shanks where most of the flexing occurred. We tapered the arm from 5 inches to 3 inches, but it is still rigid enough for nearly all of our spotwelding. We can even spotweld in areas that used to be inaccessible with any other set up.

With a conventional arm we had to constantly



EVERYTHING IS IN ITS PLACE on this spotwelder. Special racks display schedule cards and latest macro-etch sample; another rack holds 5 by 1 inch test coupons. The pilot-operated air regulator maintain precise control of pressures.

by W. W. HURD,
manufacturing engineer,
Electronics Division,
Westinghouse Electric Corporation,
Baltimore, Maryland



RIGID OFFSET ARM gets at hard-to-reach spots and supports tips under high pressure witohut deflecting.

Quality Of Your Spot Welding

change arms and electrode holders. Any weldment that was freely accessible from both sides was welded using a 5 inch arm and straight electrode holders and tips.

With this new adapter arm we have all the advantages of the straight arm and the accessibility all in one arm. We get better welds, less displacement of parts, good appearance, and machine settings are less critical.

PILOT-OPERATED AIR REGULATOR

We have equipped all of our spotwelders with pilot-operated air regulators. These give us the pressure precisely without pressure build-up or drop. We need exact pressure for consistent spotwelding of aluminum.

This is important in a low resistivity material like aluminum where the tip force controls total weld heat more than weld time and current settings. In fact, this force determines the weld nugget structure, porosity, and voids, and controls expulsion.

However, air-regulation systems have not kept pace with the advances made in electronic controls. These pilot-operated regulators give us a quicker, cleaner response to adjustment. And, they maintain better pressure regulation than in previous types.

SPECIAL SCHEDULE CARDS AND TEST SAMPLES

We display authenticated schedule cards in a rack in the right hand front of the spot welder. The section supervisor and inspector compare the card and the settings on the spotwelder to guarantee that work is being done according to military specifications. Unused cards are kept in a visible file on the opposite side of the spotwelder. All cards are color coded to each spotwelder.

The papers having to do with the actual tests are filed away and numbered to correspond to these cards. A job record card is kept on each operation we do and the number of the set up card is recorded along with the record of the macro-etch and the hourly shear test sample. This means that if any spotweld is ever doubted, we can go back and find the set up card. Then we can reproduce the same condition, welding to compare the shear values with those recorded on the job record card.

These numbered cards enable us to refer to a specific schedule in correspondence, conversation, and records. And we can record the number of the job-routing card so no time will be lost selecting a setup the next time we run the same job.

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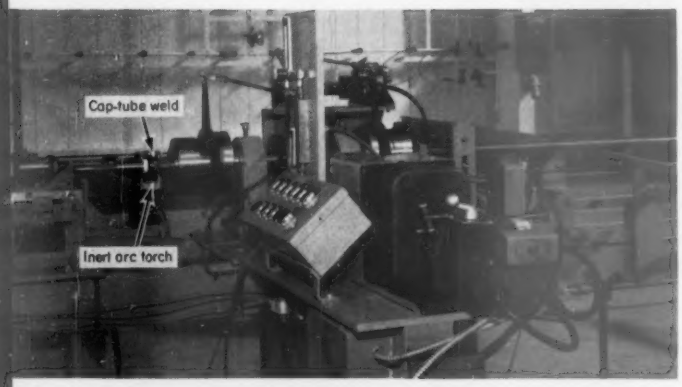
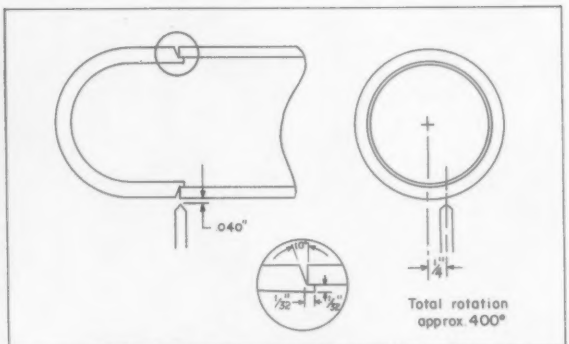
Heat Exchanger Tube Welds





T	Electrode size	Weld current amps	Starting slope amps	Starting current decay	Tail slope current decay	Rotation in degrees per min.	Argon Pre.	Argon Post	CFH
.083"	3/32	55	100	5 Sec.	10 Sec.	115	15 Sec.	15 Sec.	30
.072"	3/32	50	90	5 Sec.	10 Sec.	150	15 Sec.	15 Sec.	30

FULLY AUTOMATIC inert arc welder joins forged cap to tube. Joint geometry and welding setup (right) are critical but the cap shoulder aligns the parts quickly and concentrically.

IN BRIEF: Griscom Russell tooled up a full-fledged production line to turn out high quality, highly accurate tube and cap assemblies. Key operations were automatic welding and radiograph and penetrant inspection of the welds.

SPEED, ACCURACY, AND QUALITY are three words which best describe the way the Griscom Russell Company (Massillon, Ohio) production line makes stainless steel tube assemblies for atomic power heat exchangers. In the line, a stainless steel cap with an accurately machined edge is welded to a 15-foot tube of the same composition, the weld is radiographed, ground, penetrant inspected, and the assembly checked for dimensional accuracy.

Tube and cap sets are in two sizes and of two kinds of stainless steel: 1.523-inch O.D., 0.083-inch wall, and 1.320-inch O.D., 0.072-inch wall. The assemblies are made of Type 502, 4 to 6 chrome stainless steel with moly, and of Type 521, 2½ chrome, 1 moly stainless steel.

The tube maker is charged not only with supplying Griscom Russell with close-tolerance tubing, but with tubing that is sound beyond question. The tube maker establishes this soundness with ultrasonic inspection.

The cap is forged from plate stock. It is machined with a shoulder that fits snugly inside the square cut tubing (see sketch). The shoulder backs up the joint and provides filler metal for full-depth penetration.

Before the caps are welded they are cleaned, then etched with an identifying number that stays with it throughout fabrication.

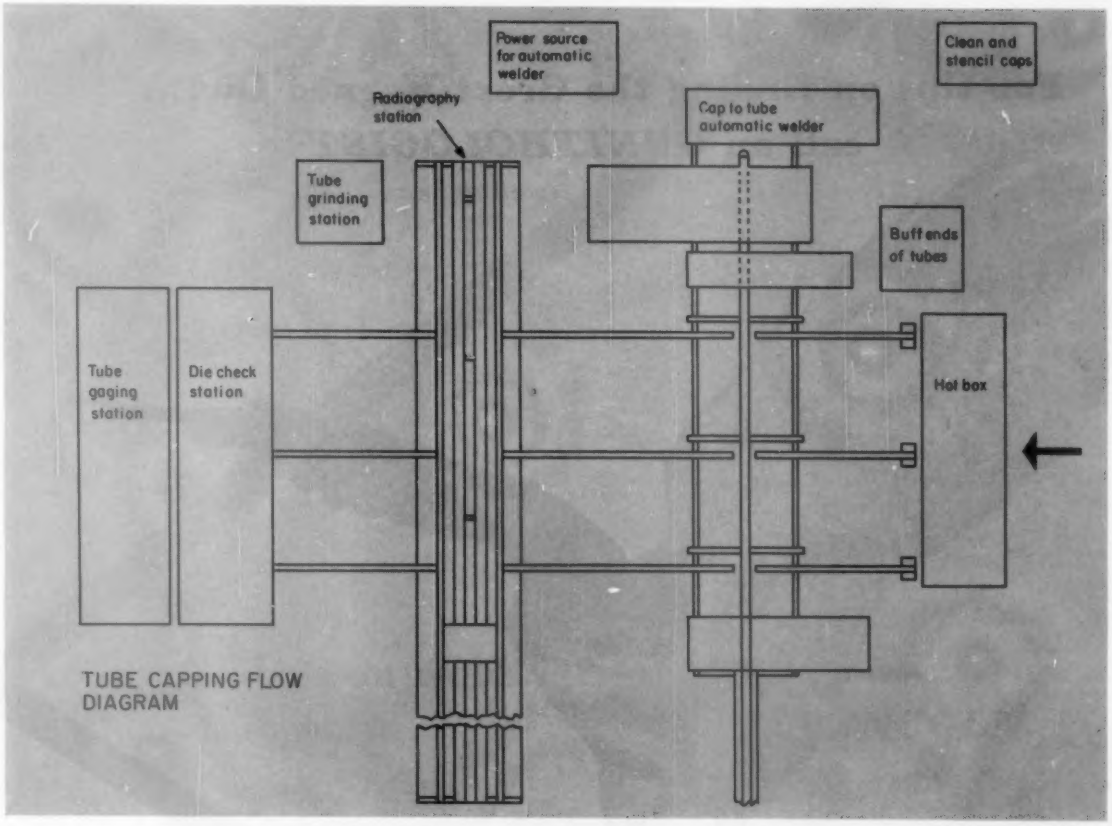
STEP-BY-STEP PROCEDURE

The production line is really a series of inclined racks with in-between stations for welding, inspection, grinding, and gauging. Here are G-R's steps for making tube-cap assemblies for atomic heat exchangers.

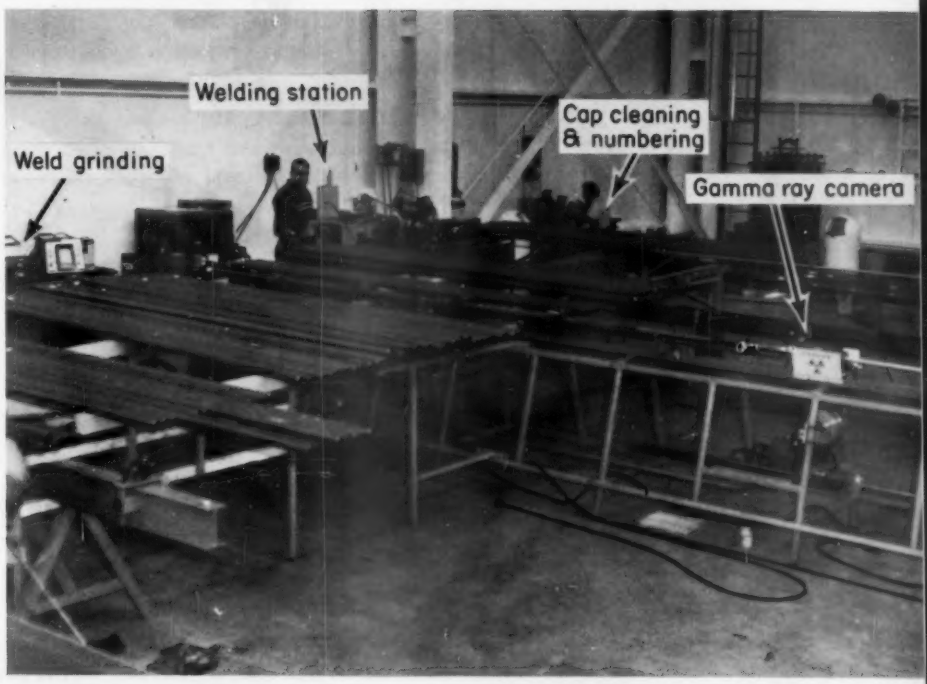
1. Load the first rack with length-cut tubing. Wire brush the end of each tube on spindle machine.
2. Let tube roll from rack into turning rolls. The tube feeds through collets until the end is in welding position. The cap is positioned into the tube end and held in place by a small air operated cylinder. The shoulder will pilot the tube to weld point position. The tube and cap will be concentric. Lower welding shield and press weld button. This control starts flow of shielding argon, and, 15 seconds later, welding current, and assembly rotation. (See current-time chart for welding cycle.) Argon flows at 20 cfh through the tungsten inert gas torch and at 10 cfh while the assembly turns 400 degrees. Then welding current stops and, 15 seconds later, argon flow. No filler metal is added in welding.
3. Fingers automatically lift the welded assembly and set it on the radiograph-ready rack next in line. Tape radiographic film around weld. In turn, tubes will drop onto laterial rolls which automatically move the tube past a Gamma-ray source until the source is under the weld. The source (Griscom-Russell uses 11 curies of Thulium 170) is in a tube-end camera. A shield surrounds the capped end of the tube to protect workers.
4. After the film is exposed and developed, view it. Reject tubes with weld flaws.
5. Radiographed tube assemblies are unthreaded after Gamma-ray exposure, are picked up by fingers and deposited on the next rack. Grind each weld flush with automatic grinder. Inspect flush weld with dye penetrant. Grinding sizes the weld so that the tubes can be inserted into a tube bundle of a heat exchanger.
6. Transfer tube assembly to gauging rack. Check O.D., I.D., and wall thickness. Griscom Russell's gauging equipment measures the I.D. of the entire tube length.

After passing this final test of excellence, capped tubes are cleaned and assembled into the heat exchanger. • •

Are Radiographically Sound

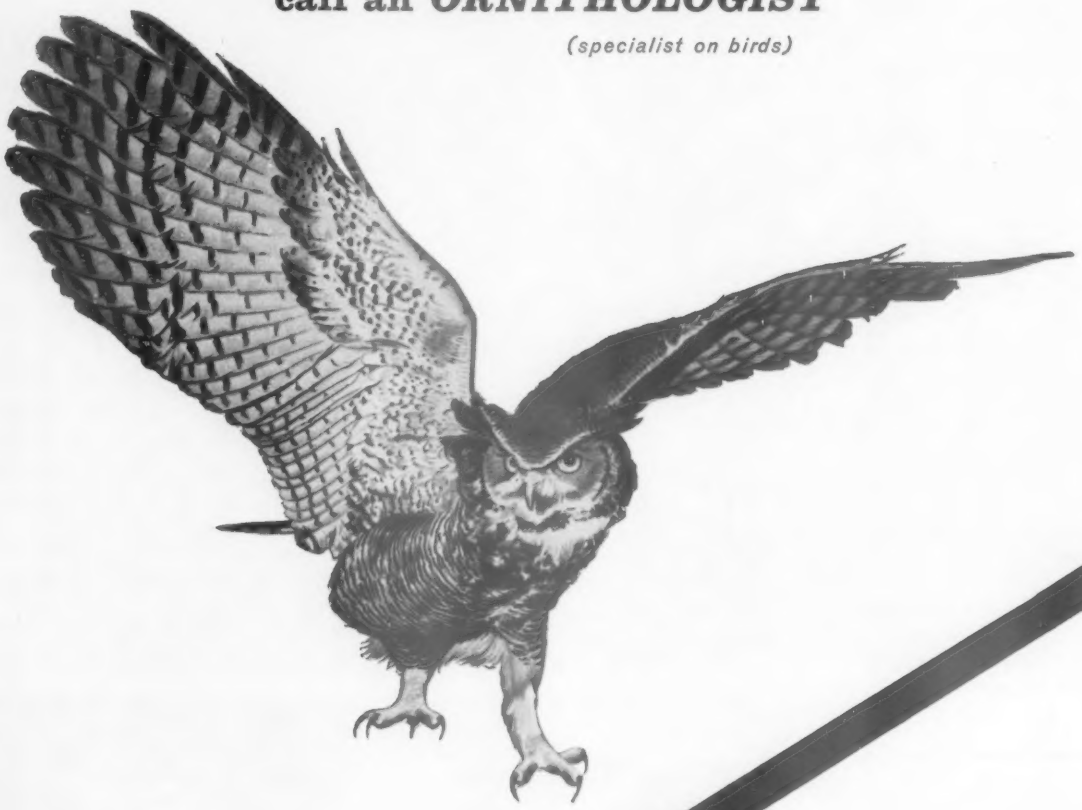


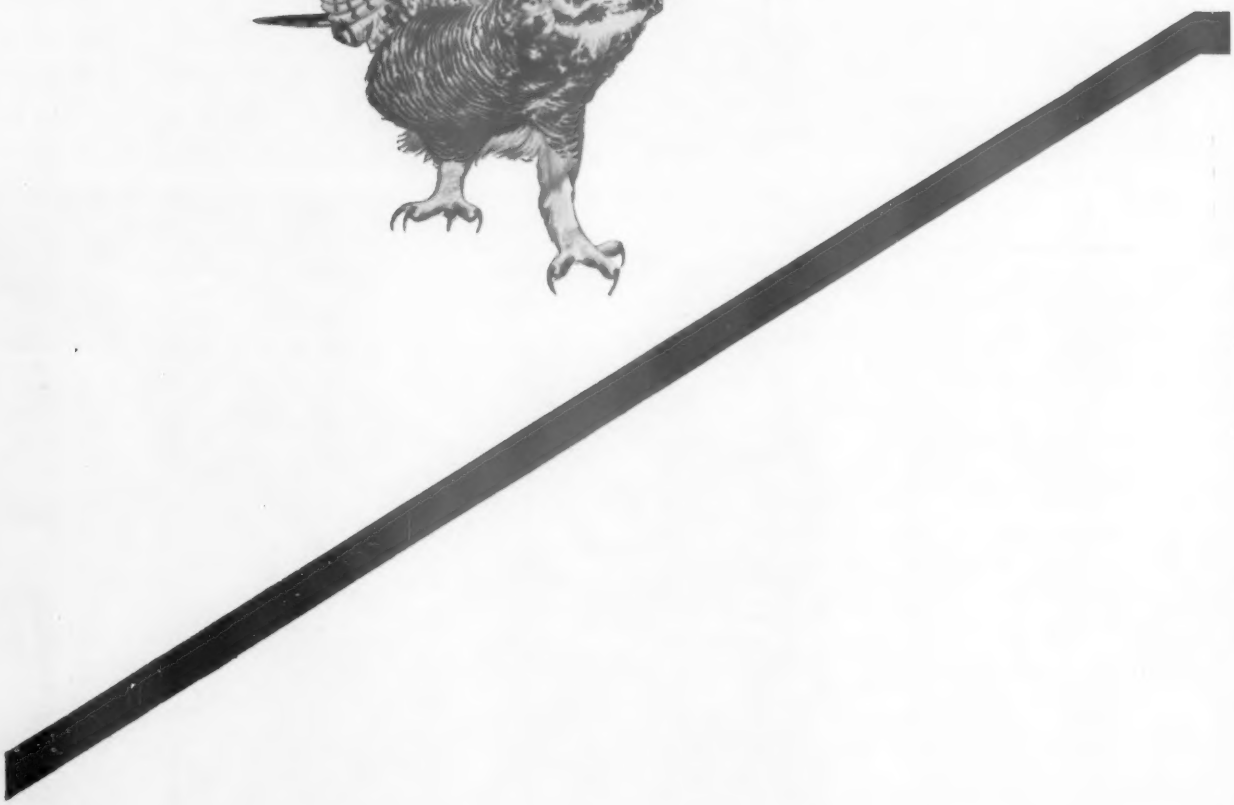
PRODUCTION FLOWS to the left in this photo and in the diagram above. Clean tubes are stored in strip heated hotbox (125-140F) until ready to weld. This insures freedom from contamination and rust. After welding, the joint is taped with radiographic film, and the assembly is carried past the Gamma-ray camera on lateral rolls. Acceptable welds are ground, dye penetrant inspected, and finally, the whole assembly checked for conformance to tolerances.



For tips on finding the Great Horned Owl...
call an *ORNITHOLOGIST*

(specialist on birds)





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for tips on welding stop-and-go jobs... call in *LINCOLN*

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A KANSAS MANUFACTURER OF MOBILE HOMES doubled the welding speed on his undercarriages by simply changing electrodes—and in addition, saved over $8000 in the first year.

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HERE'S AN IDEA

TUBE BUNDLE is prepared for welding inside portable clean-room. Six-foot extension sections can be added to the room so any length of tube bundle can be welded in it.

Portable clean-room prevents contamination during welding

BUFFALO: The Walden Plant of American-Standard Industrial Division uses a portable, expandable clean-room to control airborne dirt and dust during the welding of heat exchanger equipment.

THE PROBLEM

American-Standard welds high pressure feedwater heater tubes to tube sheets. The tubes are 5/8 inch diameter, 14 and 16 BWG Monel (Ni-Cu) or 70-30 Cu-Ni. The tube sheets are forged steel. Tungsten inert gas or metallic arc welding are used.

Cleanliness is needed during welding because airborne particles of dirt and dust cause poor welds.

THE SOLUTION

American-Standard engineers designed a clean-room. They keep the tube bundle in it from the time the bundle is laced with tubes until welding is finished.

THE EQUIPMENT

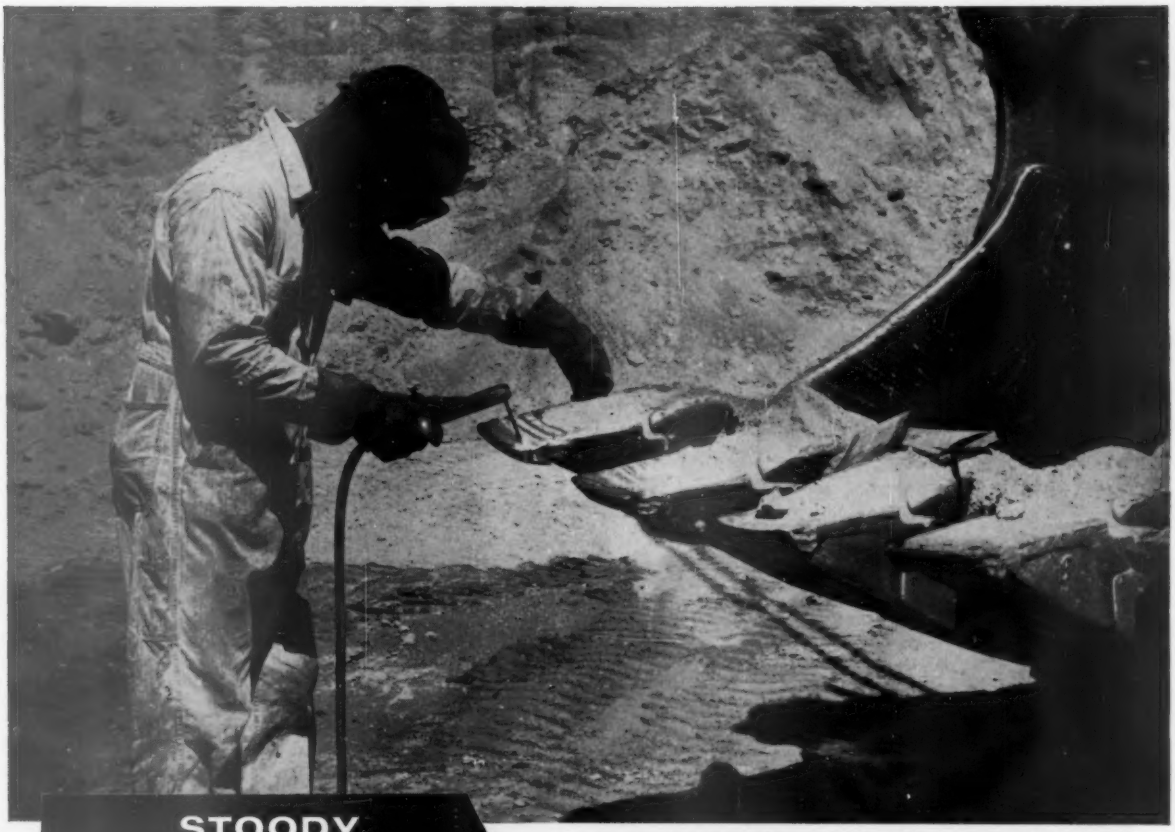
They fasten the clean-room right to the plant floor. It has hardboard side panels and a heavy duty, semi-circular polyethylene top. The room is expandable in 6 foot lengths and can be expanded to hold bundles more than 40 feet long.

A fan on the inlet vent draws air through a filter into one end of the room. Another fan at the opposite end forces air out. This maintains a continuous flow of clean air.

Sectional construction is a big advantage. When the clean-room is not being used, it can easily be dismantled. It stacks in sections and takes up minimum storage space. • •

next month:

a complete report on what management should know about the radiographic inspection of pressure vessels



TUBE BORIUM *is applied to areas of concentrated wear, such as teeth, for maximum wear protection.*

STOODY SEMI-AUTOMATIC HARD-FACING + TUBE BORIUM

where the going is toughest!

STRINGER BEADS *of Stoody 121 and Stoody 100 applied semi-automatically keep buckets in good condition.*

Usual maintenance procedures just couldn't keep buckets and teeth in shape on this job...wear was too severe. The answer was found in the semi-automatic welder applying Stoody 121 and Stoody 100 to bucket lips, sides, and runners, and to teeth and adapters.

But even then, teeth needed additional protection. To keep them digging efficiently, points were treated twice a day with several beads of Stoody Tube Borium, using manual electrodes. Tube Borium is the "last word" for protecting earth-working equipment where the going is toughest. A few beads virtually form a layer of pure tungsten carbide—your assurance of maximum wear.

Have you investigated the semi-automatic welder and Stoody hard-facing wires in your own operations? Stoody dealers (consult the "yellow pages" of your phone book) are glad to demonstrate the machine in your own plant. Write for details.

STOODY COMPANY

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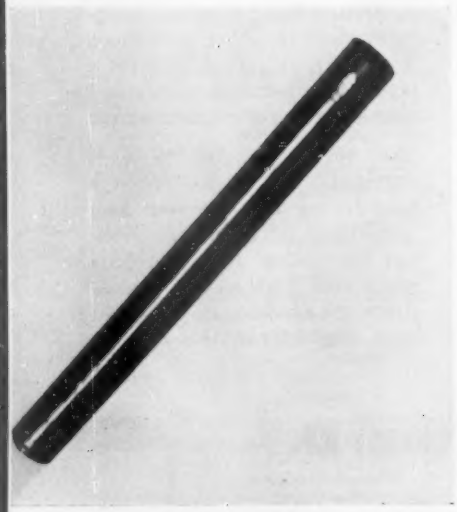
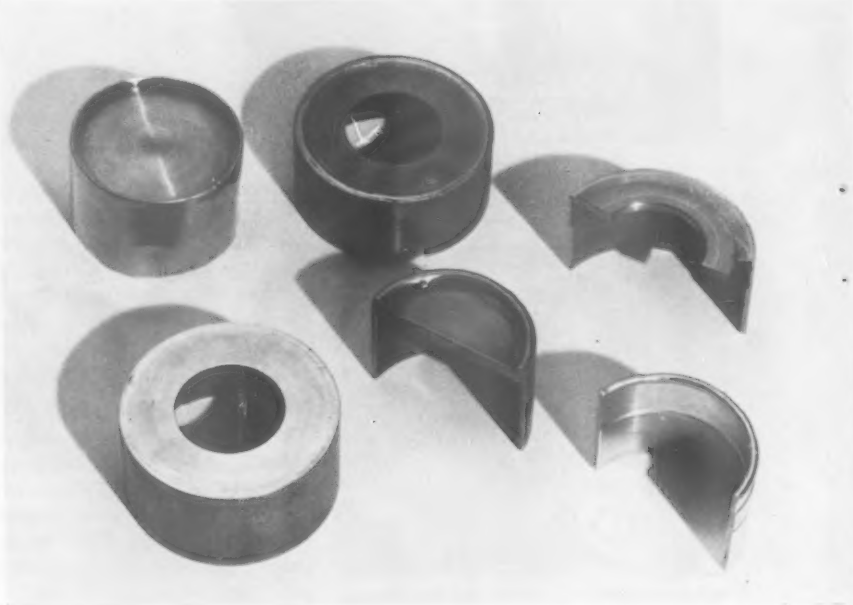
For More Information Circle No. 92 on Reader Service Card.

What We Now Know About

THIS NEWER electron beam welder operates in the medium voltage range compared with the high voltages common in the first types of equipment. It can be provided with guns capable of 50KW output.





ELECTRON BEAM WELDING worked to advantage on these stainless steel cylinders because it makes a very small weld bead. Another big advantage for the process is that it has an extremely high temperature power source which makes it suitable for hard-to-weld metals with high melting points like the seam welded tungsten tube, left.

Electron Beam Welding

by **DAVID N. REECE,**
manager, vacuum furnaces,
NRC Equipment Corporation

IN BRIEF: Has the electron beam welding process been oversold? Or does this joining method really have a future? Here's what one manufacturer of electron beam welders thinks.

DOES ELECTRON BEAM WELDING have enough advantages to justify using it to join reactive and refractory metals on a production scale?

Yes! That's the answer if you judge by the number of new welders introduced over the past two years.

No! That's the answer if you judge by the number of machines sold and now in daily use.

Electron beam welding does have an important future in some fields. But, it will not replace established processes, such as the inert-arc or its variations, for welding the more common metals, such as aluminum, magnesium, or stainless steel. Electron beam welding may be used on those metals for certain high specialized welding applications, but it is not likely to supplant the everyday methods as a basic tool.

WHERE ELECTRON BEAM WELDING FITS IN

Remember that electron beam welding has two advantages: First, an electron emitter provides point source of extreme heat. Temperature is limited by cost, life, and operating voltage. Secondly, you weld under high vacuum so no surrounding gases contaminate the metal. When these conditions are necessary to get a good weld, electron beam equipment should be used. Otherwise, other processes may prove cheaper and as good.

However, the electron beam process has some other advantages that brighten this cheerless forecast of its future:

1. A vacuum is used rather than inert gas. This cuts operating costs for some jobs and provides a cleaner weld.
2. The high concentration of energy guarantees excellent penetration and an extremely favorable depth-to-width ratio, more than 2:1, depending on the weld and voltage.
3. The process introduces no impurities from electrodes or surrounding gases.
4. Impurities evaporate from the weld area as the bead is formed. This makes the joints sound and ductile.
5. The source of heat is nearly a point; it is less likely to cause grain growth and distortion in thin sections than most other welding methods.

ELECTRON BEAM WELDING HAS ITS DRAWBACKS

The work is done inside a vacuum chamber, so it is inaccessible and must be manipulated by work tables or automatic tracking devices.

The amount of heat that can be applied—not the temperature, but the amount of heat—is fixed by the design of the electron gun. Welding guns now have somewhat limited power ratings. It appears the majority of immediate applications will be for joining metals up to about ¼-inch thick. However, successful welding has been done with an electron gun capable of delivering 50 KW into a spot ½ inch in diameter at a distance of 4 feet from the gun. So, higher powers are available for welding when needed.

A much more serious drawback is the lack of adequate data on welding techniques and equipment settings for given metals. There is little published information on recommended voltages, beam currents, welding speeds, and other welding variables. The user must find his machine settings by trial and error. It's a simple procedure, but it takes time.

Most of the welders produced to date have been sold to research and development laboratories. But, this is the fate of all new processes. Fortunately, enough development work now has been done to justify moving electron beam equipment onto the production floors.

The higher voltage welders are costly. They are precision, high voltage, complicated laboratory tools. They can be operated only by an engineer or a highly trained technician. In this equipment, which is similar to an electron microscope, most welding is done between 100,000 and 150,000 volts. Obtainable power is about 2KW, and beam diameters can be less than 0.010 inch. The distance between the last focusing lens and the workpiece is from one to two inches. The high voltages produce more concentrated beams and consequently higher heat fluxes. This helps get smaller fusion zones and smaller heat-affected zones. And, it produces remarkable fusion zone geometry under certain conditions. The depth-to-width ratio of the weld can be higher than 5-to-1. Where such ratios are needed—and they are the reverse of those you can get with conventional welding processes—there is no substitute for this equipment with its high voltage ratings and great power density.

In many simple welding applications, the high penetration may be more of a handicap than an advantage. Unless fit-up is extremely fine, the beam cuts between parts rather than fusing them. Furthermore, high voltages introduce shielding problems. Below 20,000 volts, the X-rays generated by the electron source are "soft" and are absorbed by the walls of the welding chamber. As the voltage is increased above this level, greater X-ray radiation is generated. Steps then must be taken to protect the operator. This is done both in the design of the equipment and the way in which it is operated.

FIRST GENERATION WELDING GUN

At the other end of the voltage scale is the first generation fixed focus welding gun. This is a low cost unit which incorporates a simple electron emission device consisting essentially of a tungsten filament

continued on page 76

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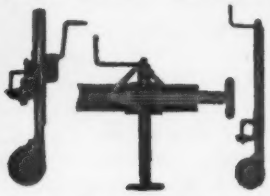

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ZIRCONIUM TUBES are welded in a special 40-ft. long dry box that is outfitted with two complete welding systems. View through porthole (left) shows tubes in position for welding.

Welding plays key role in fabricating longest zirconium tubes ever made

IN BRIEF: Three companies pooled their welding and fabricating know-how to produce zirconium tubes to hold a nuclear reactor's fuel elements.

ZIRCONIUM ALLOY pressure tubes will hold the fuel elements of a nuclear reactor. It's being built at General Electric's Hanford Works in Richland, Washington. The tubes are 57 feet long, weigh 425 lb.

WHY USE TUBES?

Tubes are being used instead of one big pressure vessel. They are economical to operate and easy to maintain.

The tubes are made of Zircaloy-2 because it has low neutron absorption and high corrosion resistance to hot water.

Three companies had a hand in making the tubes. Allegheny Ludlum Steel Corp. extruded them, the Budd Company welded them, and Tube Reducing Corp. reduced them to finished size. These companies say the

tubes are the longest and the best ever made.

EXTRUSION TECHNIQUES

Allegheny Ludlum prepares the zirconium alloy in 8-inch-square ingots, then converts it into 7-inch-diameter billets. They test carefully for hardness and composition, then machine the billets to extrusion size. Then they clad them with copper to prevent contact with air, extrusion tools, and lubricants. They heat the tubes and extrude them. After extrusion, tubes are about 4 inches in diameter and 14 feet long. They are then straightened in a roll-type straightener, pickled in nitric acid to remove copper, and then bright pickled in a nitric-hydrofluoric acid solution.

Allegheny Ludlum then makes another series of tests. They test for corrosion and they analyze one tube from each heat to see if any of the 20 possible trace elements exceed specifications. They also check dimensions.

WELDING IS THE NEXT STEP

The Budd Company matches the tubes in sets of three, bevels their ends for welding, and bright pickles them.

A mandrel is inserted in the three tubes to locate them for welding. The welding is done in the inert atmosphere of a special 40-foot dry box. This box has two complete welding systems. The tooling, the ways, and the rotating mechanism are all special.

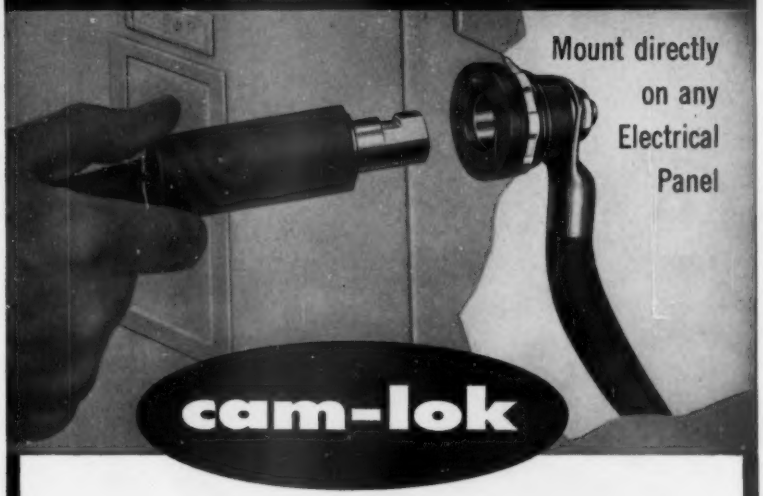
Budd makes radiographic inspections for complete weld penetration and porosity. Then they test for hardness and corrosion resistance.

REDUCE TUBE DIAMETER

Tube Reducing Corporation's *Rockrite* process reduces tubes to finish size. Dimensions are 3½ inches OD, with ¼ inch wall, and a minimum length of 57 feet. Straightness must vary less than ¼ inch in the entire length. The tube surface must be free of pits, cracks, and laminations. Surface roughness must be less than 63 microinches.

Hydrostatic and pneumatic pressure tests are made on the finished tubes. Tests are also made to make sure that specifications for corrosion and chemistry have been met. • •

New Hi-Impact Plastic Insulated
Panel Receptacles and Mating Plugs



Now, you can make fast, positive power connections to any metal panel or housing without special insulating materials. Simply punch out a hole and insert a Cam-Lok self-insulated Receptacle! Uses standard electrical lock-nuts, affords "dead-front" protection. Push in and twist Cam-Lok mating Plug and you've made a locked connection, which can be released quickly.

New Cam-Lok Receptacles eliminate costs of special insulating panels and reduce assembly time. Patented, high-pressure contact assures minimum resistance and heating.

Cam-Lok has a complete line of Receptacles and Plugs in many sizes and designs. Standard and special purpose Power Distribution Connections are available. Write today for new Bulletin No. 301.

"Dead Front" design for fast
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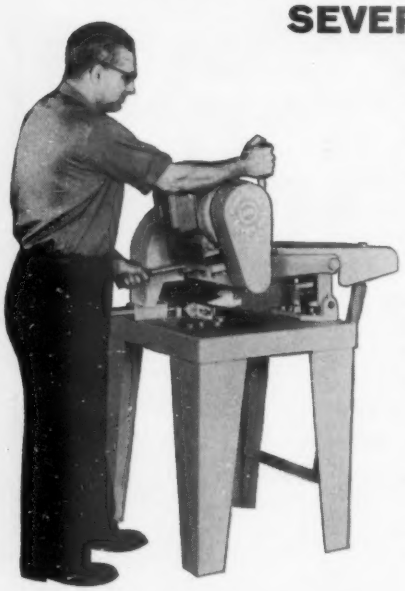
12 seconds per cut on this 2-inch steel bar!

SEVER-ALL MODEL 1-A gives high-quality cuts at low cost



Even the newest super alloys can be cut at 3 to 6 seconds per square inch on the Sever-All Model 1-A dry abrasive cutting machine. The burn-free slices of hardened steel shown above are typical of the cuts you'll get on almost any metal. *You get this speed and quality for an investment of approximately $500!*

You get big capacity, too, with the Model 1-A—up to 2″ square solids, 3½″ O.D. pipe and tubing, 3″ angle iron and 4″ channels. You can cut practically any metal. On top of that, wheel oscillation—an "exclusive" in this price range—provides cooler cutting, longer wheel life.

The Model 1-A is so easy to use, too. Wheel selection is simple—just two types of wheels do *all* your Sever-All cutting jobs. Minimum set-up time required.

You can get immediate delivery from your Sever-All distributor. *Write* us for his name — or ask for **Bulletin DH-106** for details on the Sever-All Model 1-A.

SEVER-ALL ABRASIVE CUTTING MACHINES

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TRADE MARK

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SPECIAL REPORT

The Metal Fabricating Processes

the conclusion of a 2-part report on the equipment used to prepare metals for welding and factors to consider in their use . . .

PART 2 Mechanical Cutting; Arc and Flame Cutting and Gouging; Pipe Cutting and Beveling

These cutting processes are as essential to welding as filler metals, welding current, and welding and shielding gases. Every piece welded to another must first be cut—quickly, accurately, and economically—to the right size and shape. This report is intended to show people who are welding and fabricating their products what equipment is available for mechanical cutting, arc and flame cutting and gouging, and pipe cutting and beveling, and just what that equipment will do.

turn the page for a complete report on mechanical cutting and a guide to equipment you can use . . .

Abrasive Cutting

ABRASIVE CUTTING is used on most metals, including the high-temperature alloys, the stainless steels, and hardened metals. It is not used on a small group of non-ferrous metals, typically the copper alloys.

ABRASIVE CUTTING MACHINES

Abrasive cutting is done on several types of machines. These are usually manually operated. The operator sinks the cutting wheel down into the work by pulling on a handle.

Dry cutting is done in chopper-type machines. A typical machine cuts up to 4 inch round or square solids, 6 inch diameter tubing or standard pipe, 6 by 1 inch flat stock, 6 inch angle iron, and 8 inch channels. Accurate cuts are made at the rate of 2 to 3 seconds per square inch. For instance, a 4 inch bar of hardened steel can be cut in 45 seconds, a 2 inch pipe in 3 seconds.

Some abrasive cutting machines feature power oscillation of the cutting wheel. This forward-and-backward motion as the wheel is fed down into the cut gives extra cutting capacity without excessive horsepower load on power lines. It also increases wheel life and reduces operator fatigue. This oscillation gives clean, smooth cuts because it provides a cooler cutting action.

Wet cutting is also done in chopper-type machines. Here the coolant is discharged against both sides of the wheel.

Other special machines are available. These include machines in which the work is totally submerged in coolant, fully automatic machines with oscillating heads, and those in which the work rotates and the wheel oscillates.

ABRASIVE CUTTING WHEELS

Resinoid-bonded wheels are used mostly in dry cutting operations, including bar stock, pipe, and structural shapes.

Rubber-bonded wheels are used mostly in wet work.

For the dry-chopper, the usual speed of the abrasive wheel is about 16,000 fpm, although speed can be reduced to 12,000 or 14,000 fpm. In wet work, the speed is lowered to 10,000 fpm to prevent throwing off the coolant. In totally submerged work, the speed may be reduced to about 6000 fpm.

Thin wheels—1/8 to 3/16 inch—have been the rule, but there seems to be a trend to slightly thicker wheels. In general, a thicker wheel lasts longer, cuts poorer, and requires more power. A thinner wheel wears out faster, cuts better, and needs less power.

Wheels range up to 20 inches in diameter, although 16 inches is usually large enough unless flange clearance is needed in cutting large bars or tube.

A soft grade wheel is usually used when cutting hard material, large areas, and on low-power machines. Hard wheels are used on soft materials, small areas, and on powerful machines.

Drilling

THE TWIST DRILL is probably the most standardized and the most widely used of all metal cutting tools. It is used with all machine tools that machine holes in solid material.

Six commonly used drilling machines are available to the welding and fabricating shop. These are:

Vertical-spindle drills: These are used for general and repetitive work. In this machine the drill is powerfed downward to the work. The drill can also be hand-fed.

Gang-drilling machines: This machine consists of several independent spindles mounted on one table. Each holds a tool and is similar in operation to the single spindle machine.

Multiple-spindle drills: The most common machine of this type is one in which a group of vertical spindles can be adjusted for horizontal spacing and height. The work, held in a jig on the table, is fed upward against the cutting tools. These cut in unison.

Radial-spindle drilling machines: These general purpose tools perform drilling operations on work that is too heavy and too large to be handled on a vertical-spindle machine. It consists of a bed, a column, an arm, and a drilling head that is readily adjustable, both radially about the column and vertically to suit the height of the work.

Versatile hand drills: These tools are also widely used in welding and fabricating shops. They are usually powered by electricity. Air-powered and flexible shaft-driven tools are also available.

Portable drills with magnetic—or vacuum—bases are also widely used in welding and fabricating shops. These special bases permit the drill to be mounted on horizontal or vertical surfaces.

BUYERS' GUIDE TO MECHANICAL CUTTING

NAME OF MANUFACTURER	ABRASIVE CUT-OFFS	ABRASIVE CUT-OFF WHEELS	BAND SAWS	BAND SAW BLADES	CIRCULAR SAWS	CIRCULAR SAW BLADES	DRILL PRESSES	DRILL PRESSES, PORTABLE*	DRILL PRESSES, RADIAL	DRILLS, ELECTRIC, PNEUMATIC, HAND	METAL WORKERS IRON WORKERS	NIBBLER	POWER HACK SAWS	POWER HACK SAW BLADES	PUNCH & SHEAR COMBINATIONS	SAWS, ELECTRIC, PNEUMATIC, HAND
Allison-Campbell Division American Chain & Cable Co., Inc.	●	●														
American Pullmax Co., Inc.											●	●				
American Saw & Mfg. Co.				●										●		
American Tool Works Co.									●							
Armstrong-Blum Mfg. Co.			●	●									●	●		
Atkins Saw Div., Borg-Warner Corp.				●		●								●		
Atlantic Saw Mfg. Co.				●												
Barnes Co., Inc., W. O.				●										●		
Bateman Foundry & Machine Co., Inc.											●				●	
Bay State Abrasive Products Co.		●														
Black & Decker Mfg. Co.	●				●	●	●	●		●		●				●
Boice-Crane Company			●	●	●		●		●							
Briti·h Machines & Foundry Supplies									●							
Buckeye Tools Corp.										●		●				●
Buffalo Forge Co.							●				●				●	●
Bux Magnetic Products, Inc.								●	●							
Carborundum Company		●														
Cincinnati Lathe & Tool Co.							●		●							
Clausing Div., Atlas Press		●			●		●									
Cosa Corporation												●				
Covel Mfg. Company			●											●		
Delta Power Tool Div., Rockwell Mfg. Co.	●		●	●	●	●	●									
Duro Metal Products Co.			●		●		●									
Easco Products, Inc.												●				
Electro-Mechano Co.							●									
Fenway Machine Co.												●				
Fosdick Machine Tool Co.							●		●							
Ideal Tool & Die Co.			●													
Johansson Company, I. O.							●		●							
Kalamazoo Tank & Silo Co.			●													
Lennox Tool & Machine Builders							●					●			●	
Lipe-Rollway Corp.													●			
Maquoketa Company													●			
Masters Precision Tools							●		●		●					
Max Mfg. Company	●															
Millers Falls Company				●		●				●						
Milwaukee Electric Tool Co.					●		●	●		●			●			●
Mooradian Mfg. Co.					●											
Morris Machine Tool Co.									●							
Norton Company		●														
Porter-Cable Company	●	●	●	●	●	●	●	●		●			●			●
Porter-McLeod Machine Tool Co.	●				●											
Portomag, Incorporated								●								
Raybestos-Manhattan, Inc.		●														
S & S Machinery Co.			●				●		●		●	●	●		●	
Sales Service Mfg. Co.													●			
Simonds Abrasive Co.		●														
Simonds Saw and Steel Co.				●		●								●		
Skil Corporation		●				●				●		●				●
Starrett Company, L. S.				●										●		
Stone Machinery Co.	●	●			●	●										●
Stueck, Inc., W. Whitney			●													
Tannewitz Works, Inc.	●		●		●											
Telemat Corporation	●															
Thor Power Tool Co.	●	●			●	●		●		●		●	●	●		●
Ty-Sa-Man Machine Co.	●				●											
United Mchy. Sales											●				●	
Vogel Tool & Die Corp.												●			●	
Wachs Company, E. H.													●	●		
Walker-Turner Division, Rockwell Mfg. Co.	●		●				●		●							
Wallace Supplies Mfg. Co.	●	●	●	●	●	●										●
Wells Manufacturing Corp.			●	●												

*Including magnetic bases

Metal Cutting And Metal Working Machines

THERE'S A WIDE VARIETY of these metal cutting and metal working machines available to the welding and fabricating plants and departments. They do many jobs and go by many names. However, they can be classified generally into the following two groups:

NIBBLING-TYPE MACHINES

Most of these are a variation of the standard nibbler. Nibbling is actually a punching operation which uses a small punch and die placed in the mouth of a C-frame. The die is fixed and the punch moves up and down at high speeds, up to 2,000 strokes a minute.

More advanced forms have adjustable and detachable tables and attachments for circle and straight line cutting. In addition, these machines can be used for beading, joggling, louvre cutting, folding, dishing, bending, flanging, planishing, and for shearing, profiling, contour cutting and cutting slots and square holes.

One variation uses templates to mass produce various shapes. A tracer follows the template contours and guides the machine's cutting head.

These machines are used on mild and stainless steel, aluminum, brass, and copper. They usually can handle thicknesses up to 3/8 inch. The maximum throat is about 60 inches.

Two special machines fall into this metal cutting and metal working classification. One is a plate beveler; the other is a structural beam splitter.

The plate beveler can be used to bevel large size plates with proper table support and feeding arrangement in one or two cuts. But it is really best suited for beveling small segments difficult to do by burning or grinding. Beveling is done at 11 fpm. It bevels mild steel up to 1 inch and stainless up to 3/4 inch. A series of guides and rollers support the plate which is fed into the machine where a serrated cutter makes the desired bevel.

The beam splitting machine can be used for circle cutting, straight shearing, and other cutting and forming operations. In regular use, I-beams can be pulled through it at 10 to 20 ipm. It has automatic push-button controls for starting, penetrating, and cutting.

Portable nibblers round out the nibbling-type tools used in welding and fabricating plants. These handy, lightweight tools weigh as little as 20 pounds and can cut 1/4 inch cold or hot rolled steel, 11/64 inch stainless, 5/16 inch aluminum and brass, without bending or curling the meal. They cut at about 35 ipm. Some models can cut circles as small as 2 inch diameter.

IRON WORKERS (PUNCH-AND SHEAR COMBINATIONS)

One machine in this general category cuts 2 by 2 by 1/4 inch angles and 1/4 by 4 inch flats. It will cope 1 1/4 inches in 1/8 inch thick material and will punch 1/2 inch holes through 1/4 inch material. With the clutch open, it will make 44 strokes per minute.

Another machine punches plates, bars, and structural; it cuts off round and square bars; shears plates and bars; and copes or notches. Two operators can work on this machine at one time because the punch may be used at the same time as either the section cutter, bar cutter, shear, or coping and notching attachment.

Sawing

Cutting plate and bar stock is done with three basic groups of machines:

The power-driven hacksaw is widely used. It consists of a metal blade with teeth properly cut for metal cutting and a mechanical or hydraulic means of reciprocating this blade. Stock can be hand fed or fed automatically. Bars up to 26 inches in diameter may be cut on the larger machine. This covers the practical range of rolled sections. Miter cuts on equivalent areas may be made. As a rough guide, the speed of cutting mild steel by a standard make of machine is about 2 square inches per minute and for brass, 9.5 square inches per minute.

Circular saws are also used. A circular disc with cutting teeth (sometimes these are cutting bit inserts) is rotated and fed into the work. The operation is commonly called cold sawing. It can be done with a ly aluminum) or on table models where the work is clamped for sawing. Saws may be obtained for cutting bars up to about 30 inches and consequently all rolled sections less than 30 by 30 inches. Miter cuts can be made on reduced thickness. Saws are also available for cutting at angles on material up to 14 inches diameter without moving the work.

Band saws do a wide variety of jobs, including cutting irregular contours. Generally, the work to be cut slides on a flat table with the vertical saw blade in the middle. The work is usually moved into the blade, but in some machines the blade moves and the work doesn't.

Carbon-Arc Compressed Air Gouging

RECOMMENDED AMPERAGE		
Electrode Size	Min. Amps.	Max. Amps.
5/32	80	150
3/16	110	200
1/4	150	350
5/16	200	450
3/8	300	550
1/2	400	800
5/8	600	1000
3/4	800	1400

1 — The above values are only recommended, not limits
2 — Constant voltage power sources are preferred

OPERATING DATA			
Removing Fillet Welds		Gouging double bevel butt welds	
Electrode	1/4"	Electrode	5/16"
Speed	24" min.	Speed	12" min.
Current	250 amps.	Current	400 amps.
Air Pressure	100 psi.	Air Pressure	100 psi.
Removing Fillet Welds		Beveling butt joints after fitting	
Electrode	3/8"	Electrode	3/8"
Speed	16" min.	Speed	21" min.
Current	450 amps.	Current	400 amps.
Air Pressure	90 psi.	Air Pressure	100-125 A.

THE CARBON ARC-COMPRESSED AIR cutting and gouging process melts the metal to be removed with an electric arc between the metal and a carbon electrode. The molten metal is then removed by a high velocity jet of compressed air.

The process is mechanical. It does not rely on oxidation so it is effective on all ferrous and non-ferrous metals. These include mild and stainless steel, cast iron, brass, bronze, and nickel-base alloys.

In addition to cutting and gouging, the process can be used to flush excess metal from pads, bosses, riser stubs, and hard surfaced areas. It can also be used to bevel plate edges for welding. Cutting and gouging can be done in all positions: flat, vertical, horizontal and overhead.

The equipment used consists of a torch (it looks like a regular arc welding electrode holder), a suitable carbon electrode, and a combination hose-cable, with the cable enclosed in the hose. This hose-cable is connected to an air line from an ordinary air compressor or shop line and to the cable from a DC welding machine.

DC reverse polarity is used; straight polarity is not effective with this process. The current depends on the size of the electrode being used and varies from 80 amps on 5/32 inch to 1,400 amps on 3/4 inch electrodes. The higher the current density, the more efficient the process becomes.

Air pressures are not critical. The process operates at 90 to 100 lb. pressure. This is the usual line pressure used in most shops. No regulators are needed.

Cutting speeds vary with different shops and with individual operators. Ordinarily a 3/8 inch groove 1/4 inch deep is cut at about 3 fpm.

Equipment is available for automatic operations.

Arc-Oxygen Cutting

THE ARC-OXYGEN CUTTING PROCESS is a combination of an electric arc and a jet of oxygen. It is used to pierce or cut stainless steel or cast iron up to 2 inches thick, non-ferrous metals up to 1 inch thick. The equipment used includes an AC or DC welding machine (DC straight polarity is preferred, although an AC transformer may be used), a special electrode holder with a hose connection, tubular coated electrodes, and a source of oxygen.

The tubular electrodes used in arc-oxygen cutting are covered with an inert matrix to permit insertion into deep gaps when necessary. The function of the electrode's metal or ceramic tubular core is to conduct current and maintain an arc which will heat metal to be cut to incandescence. By regulating the oxygen stream issuing from the bore of the tubular electrode, the incandescent metal is ignited. Kinetic enery of the oxygen stream expels the products of combustion and produces the cut.

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for a complete buyer's guide
to arc cutting and gouging equipment
and for flame cutting, too

Coated Electrodes For Arc Cutting

PERFORMANCE CHARACTERISTICS OF CUTTING ELECTRODE ON MILD STEELS, CAST IRON AND STAINLESS STEELS

Electrode Diameter, Inches	Plate Material	Plate Thickness, Inches	Current, Amps.	Time, Sec	Metal Removed, Oz.	Cutting, Rate, ipm	Length of Cut per 12-in. Electrode, Length	Metal Removed per Pound Electrode, Lb.
3/32	Mild steel	1	140	16.0	0.38	1.40	0.45	0.93
3/32	Cast iron	1	155	13.0	0.28	1.68	0.45	0.68
3/32	Stainless 304	1	125	16.0	0.5	2.00	0.53	1.24
1/8	Mild steel	1	195	21.5	1.2	2.53	1.09	1.35
1/8	Cast iron	1	220	20.5	1.13	3.11	1.27	1.35
1/8	Stainless 304	1	190	22.5	1.88	3.00	1.35	2.26
5/32	Mild steel	1	215	28.0	1.75	2.68	1.50	1.32
5/32	Cast iron	1	250	23.0	2.03	2.85	1.31	1.55
5/32	Stainless 304	1	235	26.5	2.63	3.60	1.92	2.00
3/16	Mild steel	1	305	29.0	3.5	4.27	2.48	1.98
3/16	Cast iron	1	315	28.0	2.75	3.34	1.88	1.55
3/16	Stainless 304	1	300	28.5	4.25	4.50	2.55	2.39

PERFORMANCE CHARACTERISTICS OF GROOVING ELECTRODE ON MILD STEEL, CAST IRON AND STAINLESS STEEL

Electrode Diameter, Inches	Plate Material	Plate Thickness, Inches	Voltage	Current, Amps.	Time, Sec	Depth of Groove, Inches	Width of Groove, Inches	Length of Electrode Consumed, Inches	Metal Removed, Oz.	Grooving Rate, ipm	Metal Removed per Pound Electrode, Lb.
3/32	Mild steel	1	58	100	14.0	1/16	3/16	5.75	0.75	24.6	2.19
3/32	Cast iron	1	63	100	15.0	. . .	. . .	6.13	0.63	24.4	1.70
3/32	Stainless 304	1	60	110	11.5	. . .	. . .	4.0	0.25	20.8	1.04
1/8	Mild steel	1	73	170	13.5	3/32	5/16	5.31	1.0	23.6	1.54
1/8	Cast iron	1	73	160	16.0	. . .	. . .	6.0	0.75	22.5	1.02
1/8	Stainless 304	1	71	175	11.5	. . .	. . .	4.63	0.63	24.2	1.10
5/32	Mild steel	1	72	230	13.5	1/8	3/8	4.63	1.25	20.6	1.54
5/32	Cast iron	1	71	250	13.5	. . .	. . .	5.25	1.5	23.2	1.62
5/32	Stainless 304	1	74	225	10.5	. . .	. . .	3.5	0.75	20.0	1.21
3/16	Mild steel	1	69	275	16.75	5/32	7/16	3.88	1.75	13.9	1.90
3/16	Cast iron	1	69	290	12.0	. . .	. . .	3.38	1.25	16.8	1.56
3/16	Stainless 304	1	68	295	12.0	. . .	. . .	2.5	1.0	12.5	1.68

ARC CUTTING of mild and stainless steel, cast iron, and copper is done with special metal-cored coated electrodes that are manipulated so the heat of the arc makes the desired cut.

These electrodes have special coatings that make them ideal for cutting, gouging, chamfering, and piercing. The coating serves as an insulator. This permits inserting the electrode into the gap of the cut without arcing on the sides of the electrode. The coating also acts as an arc stabilizer, concentrating the arc and intensifying its action. These electrodes come in a variety of diameters.

The power for metal arc cutting is usually DC (straight polarity) although AC power may be used. Standard electrode holders are used for cutting in air; heavy-duty holders are used with 3/16-inch diameter or larger electrodes; specially-constructed fully-insulated holders are used for underwater cutting.

Tungsten Arc Cutting

TUNGSTEN ARC CUTTING can be used on all metals. However, it is most widely used on aluminum, magnesium, copper and stainless steel. The process can be used manually and can be used in any position for cutting straight lines, bevels, circles, and shapes. Or it can be mechanized.

Tungsten arc cutting uses a constricted arc between a tungsten electrode and the workpiece, in conjunction with a high-velocity gas stream. The arc is concentrated and localized on a small area of the base plate; its intense heat (28,000°F) melts the metal. The gas, which is preheated by the arc, expands greatly and is forced through a constricting shielding cup. The molten metal is then removed continuously by the jet-like action of the gas stream to form a kerf. The cutting gas also protects the kerf walls from oxidation. The combined heat and force of the arc stream give a high-quality, saw-like cut.

The basic tungsten arc welding process is modified

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BUYERS' GUIDE FOR ARC AND FLAME CUTTING

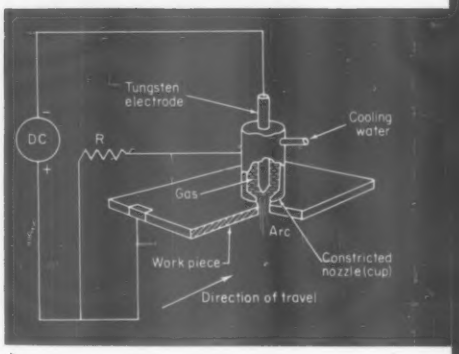
	ARC CUTTING, GOUGING							FLAME CUTTING, GOUGING					
	ARCAIR TORCHES	ARC-OXY TORCHES	CARBON RODS (ALL-TYPES)	CUTTING AND GOUGING ELECTRODES	TUNGSTEN ARC CUTTING	POWER SOURCES	UNDERWATER CUTTING TORCHES	CUTTING MACHINES MANUAL	CUTTING MACHINES AUTOMATIC	POWDER & FLUX FLUX CUTTING	TORCHES AND LANCES	TIPS	UNDERWATER CUTTING TORCHES
Acetogen Gas Co.											●	●	●
Air Reduction Sales Co.		●		●	●	●		●	●	●	●	●	
All-State Welding Alloys Co., Inc.				●									
Arcair Company	●		●	●			●						
Arcos Corporation		●		●									
Becker Bros. Carbon Co.			●	●									
Chicago Tool & Engrg. Co.		●			●		●						
Crane Company										●			
Dixie Engrg. & Mfg. Co.												●	
Dockson Corporation											●	●	
Earth Equipment Co.								●	●				
Eutectic Welding Alloys Corp.				●									
H & M Pipe Beveling Machine Co.								●	●				
Harnischfeger Corp.				●		●							
Harris Calorific Co.								●	●		●	●	●
Heath Engrg. Co.									●				
Hobart Bros. Co.			●			●							
Indiana Oxygen Co.										●			
K-G Equipment Co. Inc.							●				●	●	●
Linde Co., Div. of Union Carbide Corp.					●	●		●	●	●	●	●	
Lincoln Electric Co.			●			●							
Liquid Carbonic Div., General Dynamics Corp.									●		●	●	
Marquette Mfg. Co., Div. of Marquette Corp.				●							●	●	
Metal & Thermit Corp.				●									
Milburn, Inc., Alexander											●	●	
Miller Electric Mfg. Co.						●							
Modern Engrg. Co.											●	●	
Messer Cutting Machines, Inc. Division of American Messer Corp.								●	●				
National Carbon Co.			●										
National Cylinder Gas Div. of Chemetron Corp.						●		●	●	●	●	●	●
National Torch Tip Co.								●		●	●	●	
National Welding Equip. Co.											●	●	●
Ohio Carbon Co.			●										
Ohmstede Machine Works								●	●				
Oxo Welding Equip. Co.									●			●	
Pacific Welding Alloys			●	●	●								
Perma-Latem Welding Alloys, Inc.				●									
Reid-Avery Co.				●									
Rexarc, Inc.				●									
Shober, Inc.				●									
Smith Welding Equip. Corp.											●	●	●
A. O. Smith Corp.						●							
Stackpole Carbon Co.			●										
Steffan Mfg. Corp.								●	●				
Texas Delta Development												●	
Tolman Mfg. Co.			●	●			●				●	●	●
Universal Cutting & Welding Equip.							●	●	●	●	●	●	●
Vernon Tool Co., Ltd.									●				
Vickers, Inc., Electric Products Div.						●							
Victor Equipment Co.								●	●	●	●	●	●
Weldit, Inc.							●	●			●	●	●
Westinghouse Electric Co.				●		●			●				

AUTOMATIC CUTTING OF ALUMINUM

Plate Thickness, Inches	Cutting Speed, ipm	Arc Voltage, Volts	Current, Amps	Gas Flow cfh
1/4	100	62	240	50
1/4	300	70	380	60
1/2	75	62	280	60
1/2	150	65	400	60
3/4	45	70	280	60
3/4	75	70	350	60
1	35	70	330	60
1	50	72	400	60
1-1/4	20	74	330	70
1-1/4	50	74	400	70
1-1/2	20	76	360	70
1-1/2	35	80	400	70

AUTOMATIC CUTTING OF MAGNESIUM

Thickness, Inches	Current Amps	Current Volts	Cutting Speed in./min.	Gas Flow, cu. ft./hr.
0.250	200	60	225	70
	400	75	150	70
	400	80	300	70
0.500	240	60	150	70
	420	75	100	100
	460	70	300	100
1.000	300	75	60	70
	450	80	60	100
	660	80	75	100
2.000	350	100	25	100
	520	100	25	100
	600	90	50	100



TUNGSTEN ARC CUTTING

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slightly by the addition of a pilot-arc circuit to facilitate starting the cutting arc. And, the inner diameter of the shielding cup is reduced to about 1/8 inch to constrict the arc physically and intensify it. The highly constricted arc, which is initiated by a high-frequency spark in conjunction with the pilot-arc circuit, provides the intense and concentrated heat for cutting.

Manual cutting is done with a water-cooled torch that has a nozzle assembly with a replaceable copper nozzle. The machine holder has no handle and is mounted on a traversing unit, either a shape cutting machine or on carriages that run on tracks or beams.

In mechanized cutting of aluminum, magnesium, or copper, a ratio of 65-argon to 35-hydrogen is used; 80-argon to 20-hydrogen is the mixture used for manual cutting. Nitrogen, as well as the argon-hydrogen mixture, has been found satisfactory for cutting stainless.

Direct current (straight polarity) is used. A power supply that delivers 400 amps at 70 to 85 arc volts is needed for cutting aluminum up to 1½ inches and stainless, copper, and nickel up to 1 inch. To cut aluminum and magnesium up to 3 inches and other metals up to 2 inches, the power supply must produce 600 amps at 100 volts.

FLAME CUTTING

Manual And Machine Cutting

FLAME CUTTING is as fundamental to welding and fabricating as steel itself. Whether you use it for simple manual cutting with a single torch, or for cutting complicated shapes with complex, multiple torch machines, this process reduces your fabricating costs. It's so accurate parts seldom need cleanup machining. Flame cutting gives squarer edges than shearing on thicker sections—an important factor in good fit-up—and can give you ready-to-weld beveled edges, too.

But don't forget that flame cutting and shearing often complement each other. You shear when you want straight cuts in steel up to 1 inch thick at production rates. You flame cut when parts are irregular or the material is too thick to shear.

BACKGROUND ON FLAME CUTTING

Flame cutting is based on the fact that pure oxygen combines rapidly with steel that has been heated to its ignition or kindling temperature. At that temperature (1600°F), ajet of pure oxygen oxides the steel and the pressure blows the molten metal away to make the cut. As the steel is cut, the torch is moved slowly and uniformly along the line to be cut.

Fuel gases used in flame cutting include acetylene (the most widely used), hydrogen (usually for underwater cutting), natural gas (principally methane), liquefied petroleum gases (propane and butane), and city gas.

MANUAL CUTTING

In manual flame cutting, you get reasonably smooth and accurate cuts of any shape on all sizes of steel. Manual cutting it portable, too, it will go to the work. The quality of cut (square edge or beveled) depends on the operator's skill in adjusting, guiding, and advancing the torch. Manual cutting is usually done on plate thicknesses up to 12 inches, although equipment is available to cut through thicknesses up to 5 feet. Speed depends on the thickness of the plate. A 3-inch plate is usually cut to 12 ipm; a 3/16 inch plate at 40 ipm.

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DATA FOR MANUAL CUTTING OF CLEAN MILD STEEL (Not Preheated)

Thickness of Steel, In.	Diameter of Cutting Orifice In.	Oxygen Pressure, Psi	Cutting Speed In./Min.	Gas Consumption Oxygen Cut. Ft./Hr.	Gas Consumption Acetylene Cut. Ft./Hr.
⅛	0.0200-0.0400	15-30	20-30	18-55	6- 9
¼	0.0310-0.0595	11-20	16-26	37-93	7-11
⅜	0.0310-0.0595	17-30	15-24	47-115	7-12
½	0.0400-0.0595	20-31	12-22	66-125	10-13
¾	0.0465-0.0595	24-35	12-20	117-143	12-15
1	0.0465-0.0595	28-40	9-18	130-160	13-16
1½	0.0595-0.0810	30-45	6-12	150-225	15-20
2	0.0670-0.0810	22-50	6-13	185-231	16-20
3	0.0670-0.0810	33-55	4-10	207-290	16-23
4	0.0810-0.0860	42-60	4- 8	235-388	20-26
5	0.0810-0.0860	49-70	3.5-6.4	281-437	20-29
6	0.0980-0.0995	36-80	3.0-5.4	400-567	25-32
8	0.0995-0.1100	57-77	2.6-4.2	505-625	30-39
10	0.0995-0.1100	66-96	1.9-3.2	610-750	36-46
12	0.1100-0.1200	58-86	1.4-2.6	720-905	42-55

DATA FOR MACHINE CUTTING OF MILD STEEL (Not Preheated)

Thickness of Steel, In.	Diameter of Cutting Orifice In.	Oxygen Pressure Psi	Cutting Speed In./Min.	Gas Consumption Oxygen Cu. Ft./Hr.	Gas Consumption Acetylene Cu. Ft./Hr.
⅛	0.0200-0.0400	15-30	22-32	17-55	5-9
¼	0.0310-0.0595	11-35	20-28	36-95	6-11
⅜	0.0310-0.0595	17-40	19-26	46-115	6-12
½	0.0310-0.0595	20-55	17-24	63-125	8-13
¾	0.0380-0.0595	24-50	15-22	117-159	12-15
1	0.0465-0.0595	28-55	14-19	130-174	13-16
1½	0.0670-0.0810	22-55	12-15	185-240	14-18
2	0.0670-0.0810	22-60	10-14	185-260	16-20
3	0.0810-0.0860	30-50	8-11	207-332	16-23
4	0.0810-0.0860	40-60	6.5-9	293-384	21-26
5	0.0810-0.0860	50-65	5.5-7.5	347-411	23-29
6	0.0980-0.0995	45-65	4.5-6.5	400-490	26-32
8	0.0980-0.0995	60-90	3.7-4.9	505-625	31-39
10	0.0995-0.1100	70-90	2.9-4.0	610-750	37-45
12	0.1100-0.1200	69-105	2.4-3.5	720-880	42-52

12 HINTS FOR MACHINE FLAME CUTTING . . .

1/ Select tip orifice sizes and gas pressures to match work thickness, as given in manufacturer's tables. These recommendations are for first adjustments; make final adjustments after trial cuts.

2/ The preheat flame should be high enough to raise the steel to ignition temperatures quickly and burn off any rust, scale or paint on the work. It shouldn't be hot enough, though, to melt top of kerf.

3/ Set cutting speed so that oxygen stream does not pocket and produce a rough surface. The drag and flow of the slag will be the tipoff.

4/ Set multiple torches uniformly above work. The end of the inner cone of the preheat flame should just clear the plate surface.

5/ Keep tips clean. Scale or molten metal in orifices cause turbulence and makes the tip cut at an angle. If oxygen stream sprays out, clean the tip.

6/ Raise torch slightly in setting to a layout line. Turn on preheat flame and cutting oxygen. This enables you to see when the oxygen stream is in line with the layout.

7/ Use high purity oxygen. A decrease in purity of oxygen from 99.5% to 98.5% will increase its consumption by approximately 25%.

8/ Keep machine clean and well lubricated. This eliminates any binding action that would affect the accuracy of the cut. Clean it daily.

9/ Study the effects of thermal expansion on the accuracy of the cut. Inaccuracy may result from either warpage of thin sheet or plate, or actual shifting of the plate during the cut.

10/ Check machine. Determine if it maintains a uniform carriage travel. Constant speed is as important to cutting quality ac uniform gas flow is.

11/ For stack cutting, clamp or weld sheets or plates together. Plates should be clean and flat, their edges aligned, where the cut is to start.

12/ Use powder cutting for hard-to-cut metals. Iron powder fed into the cutting stream increases flame temperature and dilutes the refractory oxides of stainless, other alloys, and cast iron.

FLAME CUTTING

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MACHINE CUTTING

Machine cutting is more uniform and more accurate than manual cutting.

Multiple torches cut many pieces as fast as they do one. But you have to have enough volume to make machine cutting pay off. Cutting speeds range from 1 to 30 ipm on plate thicknesses up to about 18 inches.

Stack cutting is an important feature of machine cutting. Steel sheets from 1/8 to 3/8 inch thick can be stacked and dozens of parts made with each cut. Any shape can be cut. Tolerances are 1/32 inch on stacks up to 2 inches thick; 1/16 inch on stacks from 2 to 4 inches. Average stack thickness is 3 to 4 inches, but thicker stacks can be cut readily.

Shape cutting machines come in two classes:

Portable machines are usually used for cutting straight lines, curves, or circles. These are basically four-wheel, motor-driven carriages that run on a flat surface or on a straightline track. They are usually lightweight and compact. They cut at different speeds.

The stationary shape cutting machines have been developed to a high degree. Some can be considered in the class of precision machine tools. These machines mount multiple torches (usually up to 8) and are used to cut identical shapes simultaneously on a production basis. Bigger machines accommodate plates up to 10 feet wide.

Machine cutting depends on the use of templates and associated tracer devices for its efficiency.

One of the oldest, but still used shape cutting machines is the cam-type. The torch and the torch-driving wheels are on the same axis, but one above the other. A metal template goes on the template holder above the torch. A power-driven magnetic-roller follows the cam outline, making the cutting torch follow the same path over the workpiece.

Tracing devices include the simple manual tracer using a motorized tracing wheel to follow a drawn outline, automatic tracers of the mechanical type which grip the template with a motorized knurled roller or rollers, automatic tracers of the magnetic type using magnetized rollers, and electronic tracing devices using photoelectric principles. Newest developments include ratio cutting from reduced size templates, and tape-controlled machines.

Automatic adjustment of torch height is another feature of some cutting machines. An automatic control senses any deviation in plate surfaces, causing motorized torch holders to react instantly, automatically lowering or raising the torch to compensate for the deviation.

Cost estimating is an important factor in machine cutting. In their book, OXYGEN CUTTING, Slottman and Roper explain that the cost of flame cutting can be reduced to a unit basis for each thickness to be cut. These figures then can be given to the engineering department to help design fabricated parts at the lowest production cost.

Cutting costs are almost universally expressed in the cost of severing a lineal inch or foot of a given thickness of a given material. The factors involved in cutting costs are combined into this formula in order to determine the complete cost of doing a given job.

$$C = SA + (S - K)\,X + ZL$$

where C = aggregate cost
S = cost of steel in cents per pound
A = weight of the flame cut part in pounds
K = value of the scrap in cents per pound
X = weight of the scrap produced in pounds
Z = cost of cutting a linear inch or linear foot
L = length of cut in same linear units as X

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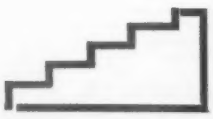

STEPS TO BETTER WELDING

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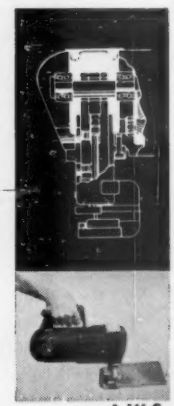
MODEL EHN

heavy duty NIBBLER



The new, lightweight Fenway 1/4" Nibbler cuts through 1/4" cold or hot rolled steel plus 5/16" aluminum, quickly and easily. Also cuts 8 gauge stainless. Its special design provides absolute safety to the operator and will cut without distortion to material. Clean cutting action reduces need for grinding and buffing edges. Has minimum cutting radius of 8". Weighs only 20 lbs. SEND FOR COMPLETE SPECIFICATIONS OR ASK FOR FREE DEMONSTRATION IN YOUR AREA.

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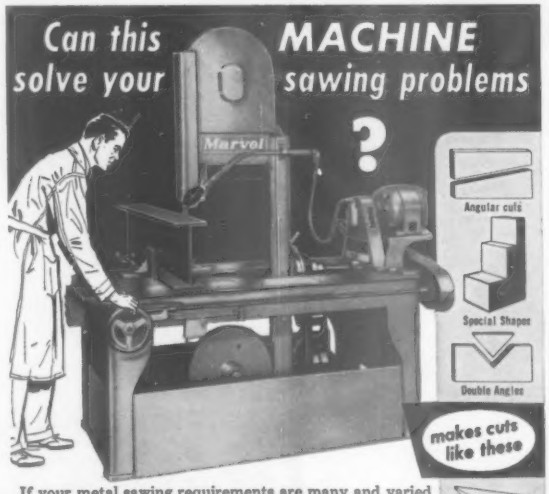

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Powder Metal Cutting

THIS PROCESS makes it possible to cut stainless steel and some non-ferrous metals with the oxy-acetylene flame. Normally this cannot be done because a very high melting point chromium oxide forms. This prevents the iron-oxidation reaction on which oxy-acetylene cutting depends. The process employs a powder which enters the cut along with the oxygen jet and by a fluxing action, oxidation, or abrasive action removes the chromium oxide.

The process is used on metals up to 14 inches thick and usually with cutting machines rather than with manual cutting torches.

Three variations of the process are:

Flux-injection process: A flux is injected directly into the cutting oxygen jet. This converts the chromium oxides into a high-fluid slag. This is removed by the oxygen jet.

Iron-rich powder process: This powder is fed into the cut. Its combustion increases the temperature and dilutes the chromium oxide with iron and iron oxide. The powder also helps cut by abrasive action.

Oxy-kinetic process: A fine silicate powder is introduced into the oxygen jet. It assists cutting by abrasion and kinetic energy.

Each of these processes employs a dispenser unit to feed the powder in the required way and at the required pressure and feed rate.

CONDITIONS FOR MANUAL POWDER CUTTING OF 18-8 STAINLESS STEEL

Thickness, in.	Nozzle size	Preheat flame length, in.	Cutting oxygen, psi	Cutting speed, ipm	Gas Consumption, cfh		Powder flow, lb per hr
					Oxygen	Acetylene	
1/4	4	1/8	60	25	96	14	15
1/2	6	1/8	50	20	190	15	15
1	6	1/8	50	15	190	15	17
2	8	1/8	50	12	370	19	17
3	8	3/16	50	9	370	19	19
4	10	3/16	50	7	490	30	19
5	10	3/16	70	6	630	30	20
6	12	1/4	50	5	660	42	22
7	14	5/16	60	4	1065	57	24
8	14	5/16	70	3	1210	57	24
9	14	5/16	80	2	1300	57	30

TYPICAL CONDITIONS FOR POWDER CUTTING NONFERROUS MATERIALS

Metal or Alloy	Thickness, in.	Nozzle Size	Cutting Speed, ipm	Cutting Oxygen Pressure, psi	Powder Flow, oz per min.
Monel	1/4	6	11	40	4 1/2
	1/2	6	5 1/2	30	6
	1	8	3	50	8
	6	16	4	50	16
nickel	1/4	6	10	40	5
	1/2	8	4	40	8
	3/4	8	2 1/2	50	8
	1 5/16	10	4	65	9
	6	16	4	50	16
Inconel	1/4	6	24	40	4 1/2
	5/8	8	7	65	9
Hastelloy C	1 7/8	12	5 1/2	50	8
brass	4	16	3 1/2	50	12–16
bronze	6	16	2 1/2	50	16
	9	16	2	50	16–24
copper	4	16	3 1/2	50	12–16
	6	16	2	50	16–24
Hastelloy B	6 1/2	12	3	60	14
aluminum	7	16	4	50	16

BUYERS' GUIDE TO PIPE CUTTING

	American Pullmax Co.	Be-Co. Engrg. Co.	Cross Mfg. Co., M. J.	H & M Pipe Beveling	Kalamazoo Tank & Silo	Line-O-Tool Co.	Mathey Co., C. M.	Nickelson Tool & Die	Porter-McLeod	S & S Machinery Co.	Steffan Mfg. Co.	Vernon Tool Co., Ltd.	Vogel Tool & Die Corp.	Wachs Co., E. H.	Wallace Supplies Mfg.	W. A. Whitney Mfg. Co
PIPE BEVELERS	●	●	●	●		●	●	●			●	●		●		
PIPE CUTTING MACHINES AND TOOLS		●	●	●	●		●	●	●	●	●	●	●	●	●	
PIPE NOTCHING TOOLS								●					●			●

A WIDE VARIETY of machines and tools are available for preparing pipe and tubing for welding. They are used for cut-off and beveling, for cutting shapes and holes, and for notching. There are two kinds: flame and mechanical.

FLAME CUTTING MACHINES

There is a specialized group of machines that do their work with flame cutting torches. They can cut off pipe and tubing, cut bevels (by changing the torch angle), or cut shapes and holes (by using patterns, templates, layouts, or cams).

One group of these pipe cutting and beveling machines is characterized by the split-gear horseshoe design. This design lets the operator place the portable machine on the pipe to make the cut. He can move the unit from one pipe to another, or change from one pipe size to another in a few seconds.

Plain barrel cutting torches do the cutting. The operator cranks a handle that turns a gear that drives the torch. Or, a flexible shaft attachment can be used to do the job remotely. The operator can then stand in front of the work and see all points of the pipe circumference at all times. This gives him better control of cutting and a better job.

These split-gear horseshoe machines are available for use on pipe sizes from 1 inch through 36 inches. Special devices make it possible to cut imperfect pipe.

A stationary tubular cutter operates similarly. Manually-operated and power-driven versions of this cutter are available. They can cut, bevel, and profile pipe and tubing from 1 inch to 25 inch diameter.

A universal power unit that rotates pipe or tubing can also be used for cutting. A special scarfing attachment, accommodating standard torches, mounts on this unit that works on the chain-tong principle. It uses 115 volts AC in the shop or DC in the field.

Pantograph-type flame cutting machines are available for pipe fabricating work. These semi-automatic guided torch machines produce straight or beveled cuts, saddle and insert-type tee intersections, lateral intersections, and miters. No layouts or templates are used. Pantograph-type cutting machines are also available for cutting round holes.

Another special automatic contour flame cutter does not need layouts, templates, nor cams. A variation of this equipment cuts perpendicular or angular holes in cylindrical shapes without cams or templates.

MECHANICAL CUTTING

A wide variety of equipment and tools are also available for the mechanical cutting and beveling of pipe and tubing. These are in addition to the usual abrasive cut-offs and power saws that can be used.

One cut-off machine available for cutting and beveling pipe uses a carbide-toothed wheel for non-ferrous metals or an abrasive disc for ferrous metals. In three cutting operations, an operator can produce a tube end that usually needs no more preparation before welding. Range of included angles is 35° to 90°.

Another cut-off device is used in a press. It shears tubing into lengths of ½ inch or more with each stroke of the press. It handles tubing with walls up to 3/16 inch and diameters up to 3 inches. Just introduced is an automatic version of this equipment in which the cut-off device is part of a base cabinet. Machines are pneumatic or hydraulic operated.

A special beveling machine can be used on mild steel and stainless pipe. Pipe ends are fed into these electrically-powered machines. A series of support

continued on page 72

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THE NEW TEC AIR-COOLED TORCH!

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RUGGED CONSTRUCTION

Durable and long lasting due to one piece construction of phenolic plastic reinforced with macerated fiber glass.

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SPECIFICATIONS

Engineered to most efficient performance.

MODEL 3110 (Pencil Grip)
Rated Capacity:
Continuous duty cycle: 80 Amp.
Overall length: 9¾"
Handle diameter: 1 inch.
Maximum electrode length: 6 inches.
Electrode diameter: .020, .040, .0625.
Cable lengths: 12½ or 25 feet.

MODEL 3330 (Pencil Grip)
As above except:
Rated Capacity:
Continuous duty cycle: 130 Amp.
Reduced duty cycle: 150 Amp.
Electrode diameter: .020, .040, .062, .093.

MODEL 3220 (Angle)
Same as 3110 except:
Overall length: 8 inches.
Handle diameter: 1 inch.
Electrode length: 3 inches.

MODEL 3440 (Angle)
As above except:
Rated Capacity:
Continuous duty cycle: 130 Amp.
Reduced duty cycle: 150 Amp.

TEC TEC TORCH COMPANY, INC., CARLSTADT, N. J. MANUFACTURERS OF VISUWELD EQUIPMENT

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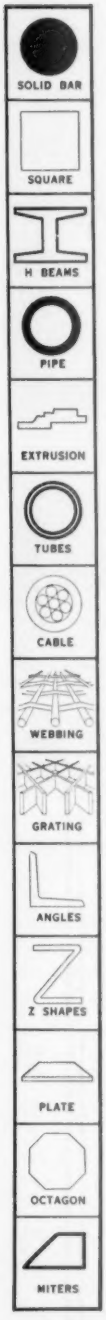

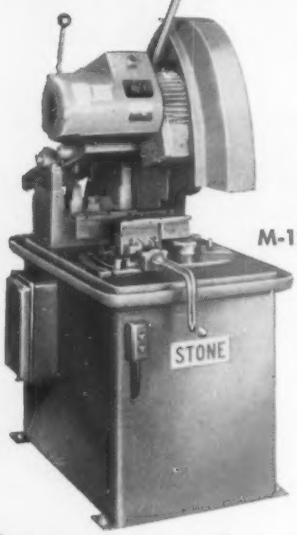

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HIGH SPEED CUTTING MACHINERY

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PIPE CUTTING *continued from page 70*

and guide rollers feed the workpiece into the machine where a serrated cutter makes the desired bevel.

For beveling, a bevel land grinder is available for cleaning and smoothing pipe cuts, and beveling lands.

NOTCHING TOOLS

A special series of tools is available for notching pipe and tubing. This equipment is used in hand- and/or power-presses.

One tool is used in hand- or power-presses to shear contours for T-joints for ½ to 2 inch pipe or tubing. Specials are available for larger sizes, square pipes, and for cutting different angles.

A second tool double notches with each downstroke of a punch press. It shears clean, from inside out, leaving two matching notches (in 180° alignment). Interchangeable dies and punches accommodate pipe and tubing from ½ to 2⅜ inches outside diameter; special units up to 3 inches, for stainless or monel.

A third tool gives clean-edge, close-fitting contour notching by making both the first and second cuts of the notch in one downstroke of the press. It notches ½ to 1¼ inch outside diameter metal tubing (16 gauge and under) at angles ranging from 35° to 90°. Special sizes and special dies are available to cut stainless, monel, etc.

• • *Illustrations and some parts for this article came from these sources: Air Reduction Sales Co., American Welding Society, Eutectic Welding Alloys Corp., and Linde Co., Div. of Union Carbide Corp.*

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SAVING both time and cost, it gives you perfect T-joints—instantly ready for welding or brazing without deformation or finishing! Twin-acting punch shears clean, from inside out, leaving two matching notches (in perfect 180° alignment) with every downstroke of the punch press. Quickly interchangeable dies and punches accommodate pipe and tubing from ½" to 2½" O.D.; special units, up to 3" O.D.

Special Arc-Twins for double notching stainless steel or monel metal and units built to your specifications can also be furnished.

Ask for twin-notched sample of pipe or tubing.

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B	2 Cuts	Stainless Steel	3/8"	3/4"

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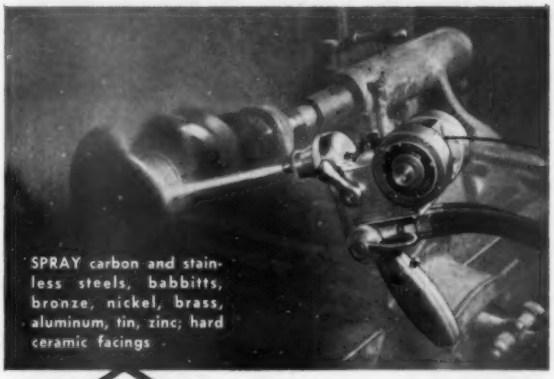

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WELDING CLAD STEELS

continued from page 43

in the root of the weld. The center of the bevels may be offset toward the cladding side to avoid replacing an excessive amount of high alloy cladding.

The materials to be welded in the head-to-shell joint of a vessel may differ in thickness because of the type of head selected or because the straight flange portion of heads thicken during spinning. If the thicknesses are different, it is best to line up the bond lines of the joints, instead of the inside or outside edges of the clad plates. The thicker section is blended into the thinner section with a 4-to-1 taper on the carbon steel side and on the clad steel side.

The strip-back weld joint is often used in automatic welding or in field-erected vessels where it is difficult to get good fit-up. The steel on the cladding side is welded to the bond line. Then it is ground smooth in preparation for replacing the cladding by overlaying. In stripping off the cladding, avoid sharp corners at the bond line. These can form notches to trap slag or become focal points for cracking.

The submerged arc welding processes may be used by shops having equipment for positioning heavy gage steel vessels. A common practice is to make several passes in the root of the weld with manual electrodes before submerged arc welding. Multiple passes are desirable; as many as 50 to 100 passes may be required to complete a weld with the proper impact properties. • •

For More Information Circle No. 6 on Reader Service Card.

RESISTANCE WELDING

continued from page 45

When an operator sets up a machine to an established schedule he makes some preliminary welds to fine tune the spot. When he has visually checked this spot, he makes three test coupons and pulls them in shear. He records these values on his daily work sheet. Next, he makes three consecutive spots on one pair of coupons. The second and third spots are sectioned and macro-etched. This macro-etched sample and the schedule card used to set up the machine are displayed in a rack on the front of each spotwelder. Test samples are required of each operator every hour; they are tested in shear. Every four hours a macro-etched sample is required.

CARE OF TIPS BOOSTS WELD QUALITY

We use specially ground cutters and holders to dress tips to the desired radius in the machine shop. This work is done in a lathe, drill press, or milling machine.

The tips are then color coded to identify the alloy (Class II for steel and brass and Class I for aluminum) and the sphericalradius. They are displayed in racks for easy selection. The radius type of tip, tip material, and holders used are specified on the set up card.

While the tips are in the spot welders, we dress them with special paddle-type tip dressers having radius surfaces covered with a fine abrasive cloth. These give us the proper tip radius. • •

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BRAZE stainless with NICROBRAZ® alloys

Brazing stainless assemblies for high temperature, high stress service requires the right brazing filler metal. One of the thirteen Nicrobraz nickel-base alloys has the qualities to satisfy your specific needs. Let Wall Colmonoy assist you in your choice.

Nicrobraz alloys are clean and consistent, controlled by laboratory tests. Available as powder, wire, sheet, and special forms, for preplacement on furnace brazed parts. For torch brazing, both rod and flux-powder pastes are made.

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675 GARDEN STREET • ELIZABETH, NEW JERSEY phone: EL 2-9613

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ELECTRON BEAM WELDING

continued from page 53

behind an aperture. The voltage is applied between the filament and the workpiece. Most welding is done between 5,000 and 10,000 volts. Spot run about 1/8 inch. The distance between the gun and the workpiece is from 1/2 to 1 inch. You focus by moving the gun.

The nearness of the electron emitter to the work, and the fact that you focus by moving the gun, limits the welder to fairly flat work. In addition, discharges in the weld area make the beam unsteady, may overload the controls and cause frequent interruptions. Welding parts with protrusions is difficult, and sometimes impossible, because electrons are attracted by the protrusion.

SECOND GENERATION WELDERS ARE SIMPLER

The second generation welders now making their appearance are less complex than the high voltage units, are less costly (they sell for about $15,000), and are designed for a wider range of applications. They also overcome some of the practical limitations, such as the short distance between the electron emitter and the work, that existed in simple, first generation guns.

This equipment usually comes with a gun capable of generating 5KW at a maximum current rating of 200 milliamperes. Maximum operating voltage is 25,000 volts. Adequate shielding is provided by lead glass in the sight ports and conventional steel vacuum chambers. While the amount of penetration and the depth-to-width ration would naturally be less than for higher voltage equipment, it is still satisfactory for most work. You can get depth-width ratios better than 1:3 in a variety of metals.

But, there are additional advantages in the second generation welder we have developed. The accelerating voltage is applied between the cathode and the anode plate, and all other components of the chamber and the focusing system are at ground potential. Compared to simpler guns, which use the work as the anode, this makes welding relatively insensitive to joint shapes. Unsymmetrical pieces or parts with sharp protrusions cannot influence the beam or cause discharge.

Secondly, the operture by which the beam is focused and through which it passes is small enough to protect the gun from pressure rises that occur when the welding material has a relatively high gas content. This overcomes the most serious difficulty that has been encountered with electron beam equipment—high voltage gaseous discharges that constantly interrupt the process. As further insurance against discharge, a separate pumping system is used for the electron source and high voltage gun componens.

Furthermore, the electron gun contains an electromagnetic focusing device. It is easy to use for various beam voltages and permits welding to be done in more than one plane. For example, you can weld corrugated materials. This used to be impossible because of critical focusing problems.

The electromagnetic lens focuses to spots from 1/32 to 3 inches in diameter by knob adjustment. You can weld anywhere from 1 to 10 inches from the end of the gun.

WELDING PROBLEMS AND TECHNIQUES

You cannot weld all metals by electron bombardment. However, you can weld tungsten, tantalum, columbum, molybdenum, titanium, nickel, zirconium, aluminum, zircaloy, and stainless. It is also possible to weld several combinations of these metals, such as copper and carbon steel to one another or stainless to titanium. A gold-plated aluminum sphere was also welded without damaging the plating immediately adjacent to the weld. The process is applicable for hermetically-sealed instruments where vacuum is already present, for topping off thermocouples, for fine welding on any thin gage stock, and for welding fuel elements. When defocused, it has also been used successfully for brazing and heat treating.

On the other hand, materials having high vapor pressure at their melting points, are difficult to weld. Magnesium and chromium are good examples. Materials having a high thermal conductivity, like copper and aluminum, can be welded but require more care than metals like zirconium, tantalum, and tungsten.

Welding is fast and requires significantly less power than when arc welding any of these metals. An average shop technicians can weld a 2-inch diameter 1/16 inch cap to a 1/16 inch Zircalloy cylinder in about 15 seconds. By jigging and muliple part handling, the four minute pumpdown time of the welder can be distributed over a number of parts. • •

cut weld cleaning time by 85%

THROW AWAY YOUR COLD CHISEL AND WHISK OFF WELD SPATTER WITH A DRY RAG! Protect-O-Metal spatter-proofing compounds make weld cleaning a breeze. Improve your welds at the same time . . . P-O-M compounds quiet the arc, improve oxidation and annealing scale, cause no porosity. No smoke, odors, or fumes.

P-O-M No. 2. Non-inflammable, non-toxic, water-soluble paste. Inorganic. Thin before applying and start welding at once. $3.40 per gallon, f.o.b. Dayton.

P-O-M No. 8. Rust- and corrosion-resistant resin base compound. Comes ready to use. Safe for all metals. Good paint primer; permits outdoor storage of sub-assemblies. $3.45 per gallon, f.o.b. Dayton.

Money-Back Trial Offer. Order a trial gallon of each today for testing in your shop. We'll cancel the bill if you're not satisfied.

Prevents Heat Treat Scale . . . up to 1500°F. Brush on, heat, brush off. All metals.

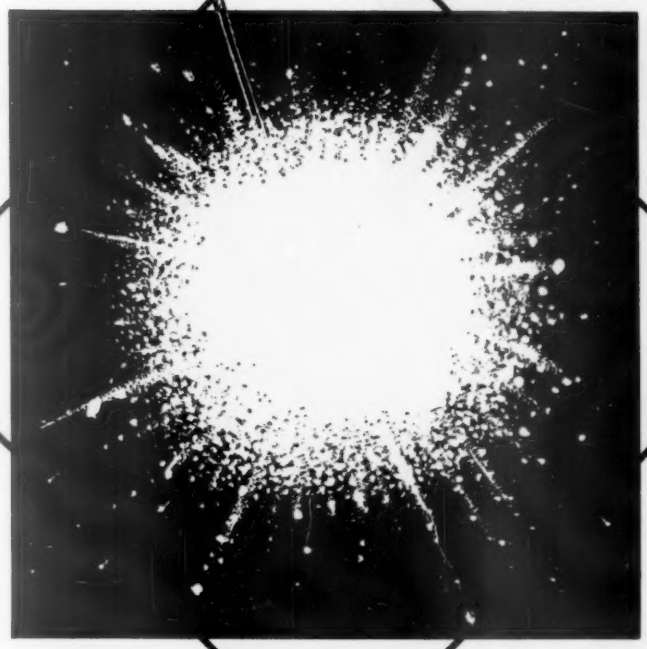
PROTECT-O-METAL

G. W. SMITH & SONS, INC. • 1701 Spaulding Rd., Dayton 3, Ohio
For More Information Circle No. 88 on Reader Service Card.

Having Welding Troubles?

ASK FOR TROUBLE FREE HI-AMP

Profit-conscious companies from coast to coast have discovered that trouble free **HI-AMP** electrode holders and accessories cost them less, while serving them better. Many purchasing agents have effected annual reductions which are substantial by switching to **HI-AMP.** Your distributor will demonstrate how **HI-AMP's** cool, trouble free operation will enable you to buy more suitably, as well as economically. See your **HI-AMP** distributor without delay.



Insist On HI-AMP Accessories From Your Welding Supply Distributor

LENCO, Inc. JACKSON, MO.

For More Information Circle No. 60 on Reader Service Card.

Al Earlbeck found a safe, fast

The sheet steel bodies of truck trailers can be murderous when you have to cut through them to do repair or special installation work. Cutting with metal saws produces edges as jagged and mean as shark teeth.

At Baltimore's Warner Fruehauf Trailer Company, distributor of Fruehauf Trailers, they tried using abrasive wheels to remove the jags but the job tore ordinary wheels to pieces so it had to be done by hand with files. And that was both slow and dangerous work for the man behind the file.

Then came Bay State distributor Al Earlbeck of Earlbeck Welding Supplies, Inc. He introduced Bay State's reinforced raised hub disc wheels and the results were astonishing. Not only did the Bay State wheels stand up to the work of grinding down jagged sheet metal edges, they even outperformed saws when it came to cutting the tough, thin, corrugated, stainless steel panels. Furthermore, they did an outstanding job of grinding down spot welds on chassis assemblies and other trailer components. Wheel-loading became a thing of the past and the Bay State wheels wore down so evenly they could be used almost down to the center hub.

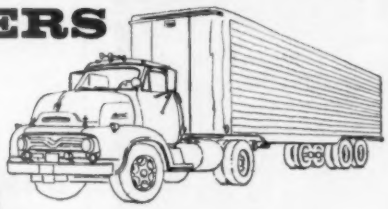
As Warner Fruehauf Shop Foreman Melvin Wengert says, now that he's been using the Bay State wheels for some time . . . "you can't beat 'em for safety and versatility. They do the job better than any other method and any other wheel . . . and that's that." Wengert, incidentally, is a man with some 20 years experience in welding and general metal-working problems.

Like Al Earlbeck, your own Bay State distributor or direct representative has both the products and the specialized knowledge that enable him to improve any grinding operation that *can* be improved. Why not turn him loose on yours and see what he comes up with? *Better grinding at lower cost . . . that is his business.*

(Left) Warner Fruehauf Shop Foreman Mel Wengert checks weld bead with Al and Tom Earlbeck after weld had been ground with the same wheel that was used to smooth sheet metal edges of aperture cut in trailer body.

(Below) Operator Jerry Clark trims stainless steel burrs from opening made for installation of refrigeration unit.

answer to grinding the "shark's teeth" on TRUCK-TRAILERS



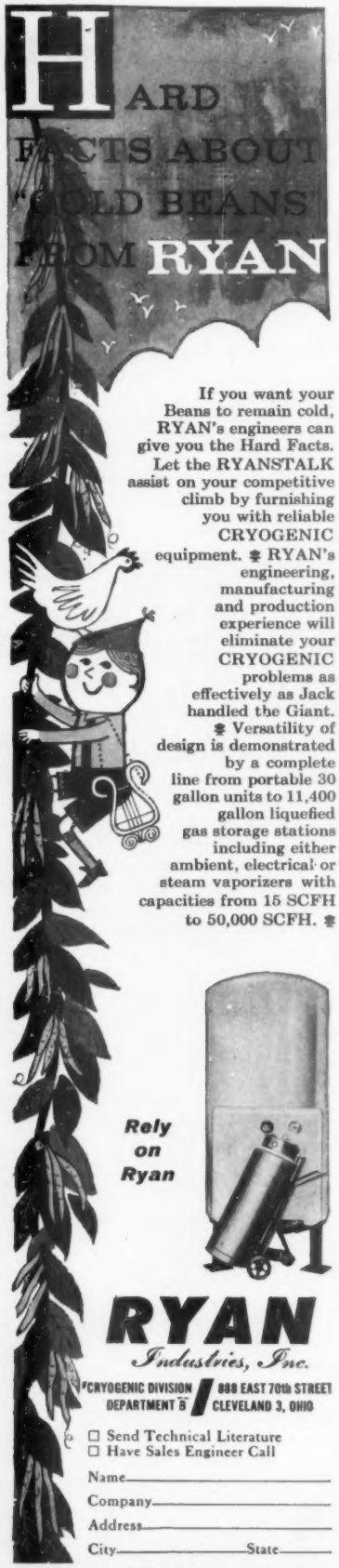
Al Earlbeck has 25 years of practical experience in grinding problems and has also taken just about every course there is in welding technology . . . starting at Baltimore Polytechnic Institute and winding up with advanced courses at Johns Hopkins. His son, Tom, is currently going through the same tough schedule of technological training. Meanwhile, Al himself sponsors courses and serves as executive of many technical associations as well as running Earlbeck Welding Supplies, Inc. He has tried other competitive grinding wheel lines but dropped them because he always found Bay State superior in both quality and service.

BAY STATE ABRASIVES

BAY STATE WHEELS of PROGRESS

Bay State Abrasive Products Co., Westboro, Massachusetts.
In Canada: Bay State Abrasive Products Co., (Canada) Ltd., Brantford, Ontario.
Branch Offices: Chicago, Cleveland, Detroit, Los Angeles, Pittsburgh. *Distributors:* All principal cities.

For More Information Circle No. 24 on Reader Service Card.


HARD
FACTS ABOUT
"COLD BEANS"
FROM RYAN
If you want your Beans to remain cold, RYAN's engineers can give you the Hard Facts. Let the RYANSTALK assist on your competitive climb by furnishing you with reliable CRYOGENIC equipment. ❦ RYAN's engineering, manufacturing and production experience will eliminate your CRYOGENIC problems as effectively as Jack handled the Giant. ❦ Versatility of design is demonstrated by a complete line from portable 30 gallon units to 11,400 gallon liquefied gas storage stations including either ambient, electrical or steam vaporizers with capacities from 15 SCFH to 50,000 SCFH. ❦
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Circle No. 84 on Reader Service Card.

REFERENCE DATA *catalogs, handbooks, manuals*

MECHANICAL PRESS BRAKES made by Steelweld Machinery Division, Cleveland Crane & Engineering Co., are the subject of an illustrated 50-page brochure. Catalog 2023-B covers latest features and new models added to the Steelweld line. The specifications table has been enlarged and covers machines from 160 to 1250 tons, mid-stroke capacity.

For More Information Circle No. 300 on Reader Service Card.

CYLINDER VALVES are fully described in Bastian-Blessing's new, two-color, 16-page Catalog GA. The new, rugged, low silhouette 850 series cylinder valve is featured along with cylinder valves for service with acetylene, medical oxygen, carbon dioxide, and other gases.

For More Information Circle No. 301 on Reader Service Card.

A LOW-MELTING, SELF-FLUXING alloy for soldering aluminum is featured in a data sheet from All-State Welding Alloys Co., Inc. The company's #55 Rubbon aluminum solder has a working range of 705°F to 720°F and was developed specifically for fluxless soldering of mitered joints on aluminum windows.

For More Information Circle No. 302 on Reader Service Card.

MANUAL HARDSURFACING is the title of Lincoln Electric Company's Bulletin 3100.1. It discusses the economics and metallurgy of hardsurfacing, analyses the various conditions which demand surfacing, and tells which electrodes to use for various applications.

For More Information Circle No. 303 on Reader Service Card.

ALLOYS THAT ARE RESISTANT to abrasion, impact, corrosion, and heat are featured in a series of data sheets from Coast Metals, Inc. Each sheet gives complete engineering data on a single alloy, including physical properties and nominal chemical composition, typical applications and recommended finishing procedures.

For More Information Circle No. 304 on Reader Service Card.

A UNIVERSAL POWER UNIT for turning and positioning tanks, pipe and tubing for welding and cutting is featured in a 4-page catalog from BE-CO Engineering Co. Unit operates on the chain-tong principle, has a maximum circumferential turning force of 400 pounds at surface speeds up to 30 ipm.

For More Information Circle No. 305 on Reader Service Card.

THREE TECHNICAL BULLETINS on nondestructive testing are available from Balteau electric Corp. The first two explain the use of portable X-ray equipment in aircraft maintenance work and in storage tank fabrication. The third compares all popular nondestructive testing methods and lists the applications best suited to each.

For More Information Circle No. 306 on Reader Service Card.

A HAMMER IS THE ONLY tool needed to make perfect cable connections, according to a brochure from Bernard Welding Equipment Co. The brochure introduces the company's new Red-E lugs and splicers that are easily installed by merely inserting the stripped cable and driving down a self-contained impact punch with an ordinary hammer.

For More Information Circle No. 307 on Reader Service Card.

A JOINT PREPARATION SYSTEM that can be used on tubular products is explained in literature from Wallace Supplies Mfg. Co. A brochure explains how the company's DeWitt System can make a variety of joints for fabricating mild steel, stainless, and aluminum tubing and pipe.

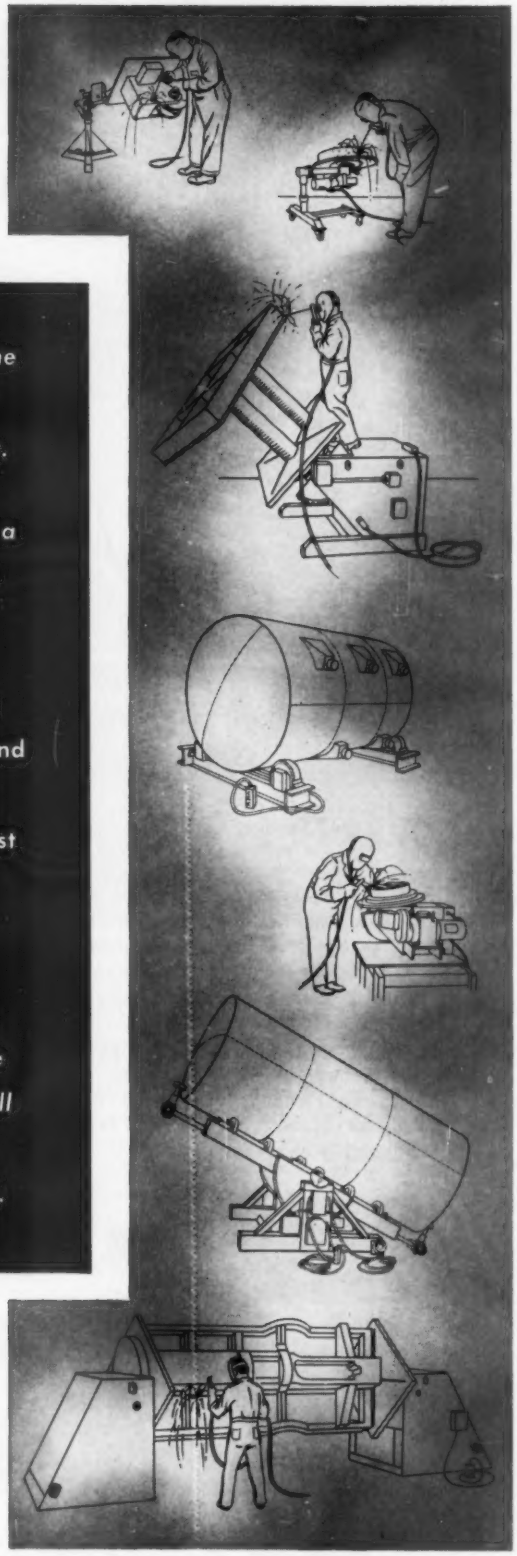
For More Information Circle No. 308 on Reader Service Card.

A BEVELING MACHINE that can be used to bevel mild steel or stainless on a production basis is described in a brochure from American Pullmax Co., Inc. Featured is the company's Model X8 beveler. Capacities, dimensions, and operating details are given.

For More Information Circle No. 309 on Reader Service Card.

FACTS AT YOUR FINGERTIPS: *If you want copies of the catalogs featured on these pages, just circle the appropriate numbers on the bound-in Reader Service Card. We'll do the rest.*

POSITIONEERING *with* Aronson



In a board walk the largest item of expense is the lumber; in a splendid violin the least item of expense is the lumber.

In a plain wall the stone is the chief cost; in a piece of classic statuary the cost of the stone is hardly reckoned.

This principle, in a certain degree, applies to the making of a good positioner. We do not pretend that we put more or less material into each Aronson Positioner; but we do put in the best materials, the scientific knowledge and expert skill and the long-continued care which no ordinary positioner contains.

If you want to get rich music or a treasure of the sculptor's art or a job of positioning that will be satisfactory and increase your profits, you must pay for something other than raw material.

UNIVERSAL BALANCE® POSITIONERS
BENCH TURNTABLE POSITIONERS
GEAR DRIVEN POSITIONERS
HEADSTOCK - TAILSTOCK POSITIONERS
TRACTRED® TURNING ROLLS
TURNTABLES
FULLY AUTOMATIC POSITIONERS
MAGNETIC WELDING CLAMPS

Specifications on Request

Quality POSITIONERS by **Aronson MACHINE COMPANY, INC.**

ARCADE, NEW YORK

WELDING POSITIONERS • TANK TURNING ROLLS • TURNTABLES

For More Information Circle No. 20 on Reader Service Card.

...Low Glare & Low Fuming Characteristics
Assure Operator Comfort & Quality Results

GB 88 Flux is recommended for silver brazing steel, brass, copper, stainless steel, monel, inconel, chrome alloys, silver and gold. It is known throughout the industry as the "Production" flux . . . proved and dependable. Because operators recognize an improvement in the quality of their silver brazing jobs when they use GB 88. And they like its glare and low fuming characteristics.

GB 88 Flux is stable in use as well as in storage. It is fully active to 1650°F. Order GB 88 Flux in the size container that suits your needs.

For best results team up GB 88 Flux with GB Silver Brazing Alloys in the shape and size your jobs call for: random coils in all diameters, strips, straight lengths, pre-formed rings and special shapes.

Write for details. A FREE working sample of GB 88 Flux will be supplied promptly on request.

Goldsmith Bros.
DIVISION OF NATIONAL LEAD CO.
900 WEST 18th STREET • CHICAGO 8, ILLINOIS

For More Information Circle No. 47 on Reader Service Card.

WELDING HELMETS and handshields are the subject of illustrated literature from Flood Safety Products Co. Featured are the company's fiber glass helmets with new Fit-Rite headgear.

Circle No. 44 on Reader Service Card

A COMPLETE LINE of axle assemblies, jacks, couplers and spindle end assemblies are the subject of literature from Hammer Blow Tool Co. Brochure explains engineering service that is available to solve application problems.

Circle No. 50 on Reader Service Card

AN IRON BENDER that bends, flats, squares, angle iron, pipe, tubing and conduit is featured in literature from Hossfeld Mfg. Co. The bulletin describes in detail the company's #2 Universal iron bender.

Circle No. 310 on Reader Service Card

WELDING GLOVES, mittens, and clothing are featured in literature from John Tillman & Company. Brochure explains how packaging in polyethylene bags protects gloves and garments until they are used.

Circle No. 97 on Reader Service Card

CARBON AND GRAPHITE products for welding are the subject of a catalog available from Becker Brothers Carbon Co. Described and illustrated are welding electrode, welder brushes, and electrodes for carbon arc-compressed air gouging and cutting.

Circle No. 26 on Reader Service Card

ONE AMMETER that can be used for AC or DC welders is featured in a catalog from Columbia Electric Mfg. Co. Described and illustrated is Tong-Test ammeter with interchangeable ranges up to 1000 amperes.

Circle No. 311 on Reader Service Card

AN IRON WORKER that cuts angles and flats is described in literature from Bateman Foundry & Machine Co. Featured is the Bateman Bantam with one-stroke cycle clutch that is hand- or foot-operated. Literature explains how the machine can be used for punching and coping.

Circle No. 23 on Reader Service Card

QUICK CHANGE electrode holders and how they can be used as a "Do-It-Yourself" die unit for high pressure spot welding, projection welding nuts or studs, or used in multiple to form a die for making several projections in an assembly is explained in literature from S-M-S Corporation.

Circle No. 85 on Reader Service Card.

SIMPLIFIED SILVER BRAZING with a flux-coated rod is explained in literature from Eutectic Welding Alloys Corp. Brochure describes in detail how EutecSil 1020 FC eliminates mixing, applying, and drying of fluxes and makes high quality, strong joints on ferrous and non-ferrous metals.

Circle No. 41 on Reader Service Card.

THE MANY FACES of calcium carbide are the subject of a 16-page brochure published by the National Carbide Co. The manufacture of calcium carbide and acetylene is described and illustrated.

Circle No. 313 on Reader Service Card

POWER HACK SAWS marketed by Sales Service Mfg. Co. are the subject of a bulletin. Described and illustrated are 10 sizes of Keller hack saws in five capacities from 5- by 4-inch to 10½- by 9-inch.

Circle No. 314 on Reader Service Card

TWO METAL CLEANING COMPOUNDS are featured in literature from Chemclean Products Co. Described is one compound which removes oxides from aluminum and stainless before welding and one which brightens copper, brass, or bronze in a single dip.

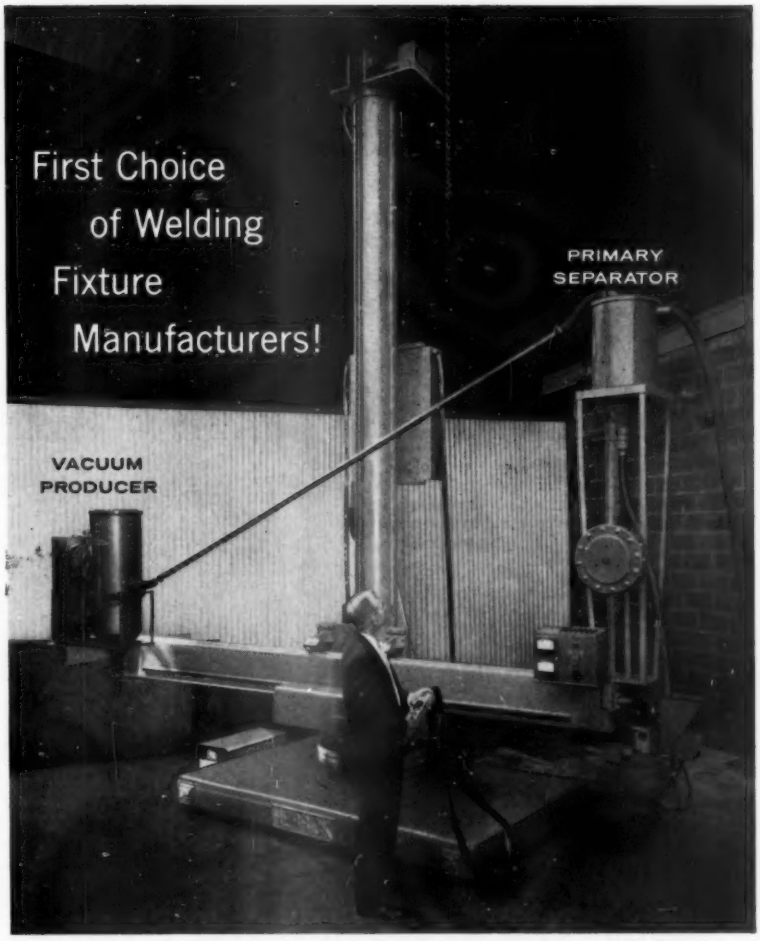
Circle No. 29 on Reader Service Card.

HEAVY-DUTY ELECTRICAL TOOLS are the subject of condensed Catalog G20 issued by Milwaukee Electric Tool Corp. Featured are drills, saws, shears, grinders, and polishers.

Circle No. 315 on Reader Service Card

STOPPING HOLDER HEATING in two ways is the story told in literature from Tweco Products, Inc. The company explains how its ball-point connection and cable connection support do the job and eliminate poor cable connections and broken strands behind the connection.

Circle No. 99 on Reader Service Card.



INVINCIBLE UNITS

Automatically Reclaim Flux

This automatic ram type manipulator made by C. B. Herrick Manufacturing Corp., Cleveland, is used for welding steel plate bridge girders. Mounted on the carriage, an Invincible Flux Recovery Unit travels with the welder along the full length (up to 130 feet) of the girder. It recovers all unfused flux . . . removes powder . . . and returns slag-free, dust-free flux to the welder automatically, in a continuous flow.

Fixture manufacturers—and users—specify Invincibles because they are engineered specially for handling abrasive materials and for continuous operation. Their rugged construction assures years of full-time operation—no loss of production time.

Savings in reclaimed flux alone pay their cost in a few months, even weeks. In addition, Invincibles save costly man-hours over manual methods, speed-up production, minimize rejects.

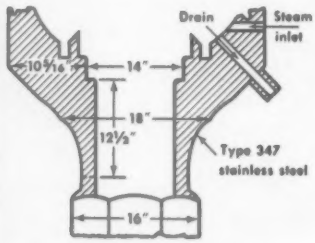
In 14 standard automatic and manual models (1½ to 7½ H.P.). Accurate free surveys of your submerged arc welding operations can be made on short notice. Resident engineers in all principal cities.

Send for Invincible Flux Recovery Equipment Folder.

INVINCIBLE VACUUM CLEANER MFG. CO.
DOVER, OHIO

For More Information Circle No. 57 on Reader Service Card.

Profit through E.A.I. Research



Uniform, through-and-through heating of the thickest sections of the big stainless steel valves was provided by the Smith-Dolan method, with precision control of temperatures (2-hour dwell at 1900°F.). Drawing shows cross-sectional dimensions.

Standard Smith-Dolan units come equipped with eye hooks and wheels for easy portability, and with instrumentation for recording permanent charts of the heat run.

SMITH-DOLAN On-the-Job HEAT TREATMENT

Solution to Weld Embrittlement Problem at Consolidated Edison

Public utilities are among the largest users of the Smith-Dolan System of Low-Frequency Induction Heating. They want to keep their service uninterrupted, their costs low, and they find that this portable system simplifies the problem of pre-heating and post-annealing in producing sound welds, and in making dependable repairs.

A typical application of the system by a public utility was described in a recent article in Welding Design & Fabrication.* At Consolidated Edison's No. 10 Turbine Generating Station in New York City, two large steam pressure valves made of Type 347 stainless had to be repaired because of weld embrittlement. Removal to the shop for heat treatment would have proved costly and time taking. With the Smith-Dolan portable units, the work was completed on the job within 12 hours.

Learn about the savings and other benefits your company can obtain from the Smith-Dolan System. It is today's most versatile heat treating method, simplifies and upgrades work quality in numerous applications. Write for brochure, "Smith-Dolan System of Low-Frequency Induction Heating."

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Newark 8, New Jersey

ELECTRIC-ARC

For More Information Circle No. 37 on Reader Service Card.

HARDSURFACING CATALOG issued by McKay Company gives detailed alloy recommendations and welding procedures for the repair and reclamation of over 500 specific equipment parts.

Circle No. 317 on Reader Service Card

A PIPE-CUTTING PANTOGRAPH and how it can be used to make all types of beveled cut-offs used in pipe fabrication work is the story told in an illustrated brochure from Vernon Tool Co., Ltd.

Circle No. 318 on Reader Service Card

PIPE CUTTING AND BEVELING machines made by H & M Pipe Beveling Machine Co. are featured in a 4-page catalog. Standard equipment and a variety of special equipment and accessories are described and illustrated.

Circle No. 49 on Reader Service Card

STEEL MILL WEAR problems and practical repair solutions are featured in the 2nd Quarter, 1960, issue of the Ampco Welding News. Another article in that publication explains the fabrication of composite draw dies to eliminate galling and scratching.

Circle No. 319 on Reader Service Card

"FACTS ABOUT METAL WEAR for Maintenance Men" is the title of Data Sheet Form 103 just issued by Rankin Mfg. Co. The bulletin explains how to measure wear resistance, how to make tests, the effect of hardness, etc.

Circle No. 320 on Reader Service Card

PORTABLE NIBBLERS that will fit into any standard size tool box are the subject of literature from Fenway Machine Co. Complete details are given for these tools which can be used to cut stainless, mild steel, and non-ferrous metals.

Circle No. 42 on Reader Service Card

ULTRASONIC FLAW DETECTION is the subject of Bulletin T200 issued by Branson Instruments, Inc. The booklet includes operation, techniques, and a complete list of specifications for the company's Model 5 Sonoray portable ultrasonic flow detector.

Circle No. 321 on Reader Service Card

SINGLE-SOURCE SERVICE for welded fabrications is explained in a brochure from R. C. Mahon's Steel-Weld Division. Described in detail and illustrated are the company's extensive facilities (welding, machining, and assembling) for making strong, high quality, attractive weldments.

Circle No. 105 on Reader Service Card

ABRASION-RESISTANT STEEL is the subject of a brochure offered by Great Lakes Steel. Complete technical data is given on the company's X-A-R 15 and X-A-R 30 steel that are available in hardnesses from 360 to 400 BHN—or in a range from 265 to 500 Brinell.

Circle No. 322 on Reader Service Card

FLUX COATED RODS to eliminate the use of fluxes when silver brazing, are explained in literature from Eutectic Welding Alloys Corp.

Circle No. 41 on Reader Service Card.

EXTRA HEAVY-DUTY welding equipment trimmed down for low cost is described in literature by A. O. Smith Corp.

Circle No. 90 on Reader Service Card.

OXYGEN CUTTING machines marketed by Messer Cutting Machines, Inc., are the subject of available literature. Design details and operating instructions are given.

Circle No. 27 on Reader Service Card

HYDRAULIC TOOL IDEAS are given in a booklet from Blackhawk Mfg. Co. The booklet explains how the company's hydraulic tools can be used for fitting up, for eliminating distortion, and in low-cost fixtures for welding complex assemblies.

Circle No. 69 on Reader Service Card

FULLY AUTOMATIC, air-operated No. 407 spot welding gun is described and iillustrated in a catalog sheet from Aro Spot Welder Division, Guthery Machine Tool Corp. Specifications are given.

Circle No. 324 on Reader Service Card

SILICON RECTIFIER DC welders are featured in a data sheet from Metal & Thermit Corp. Three Murex machines with current ranges up to 625 amperes are described and illustrated.

Circle No. 325 on Reader Service Card

BUY the BEST

It's the entirely new
FIBRE-METAL
"QUALITY LINER"
LINE

for WINTER WARMTH & COMFORT

Warmth, durability, comfort and convenience are built into Fibre-Metal's completely new *quality* line of winter liners... for greater worker safety and "work ability." Designed for all safety hats and caps in the field, these winter liners are made of high quality, water-repellent, mercerized and sanforized fabrics... expertly tailored for maximum service life. *Ask your welding and safety supply distributor* NOW for our more descriptive bulletin or just order by model number and size.

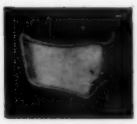
Model FLF (Small and large sizes). For cold to frigid climates. Heavy gray outer flannel, red knit lining. Long neck for extra wind protection. Chin strap with adjustable snap. Provision for snap-on MF Mouthpiece to give additional face protection!

Model FLF-I (Large size only). Same as FLF but includes an extra urethane inner lining for maximum warmth in ultra-frigid climates. Provision for MF Mouthpiece.

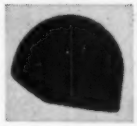
Model FLF-Z (Small and large sizes). Same as FLF but features zipper detachment of ear flap and neck section. For mild to frigid climates. Chin strap with adjustable snap. Provision for MF Mouthpiece.

Model FLF-E (Small, Large and Extra-Large sizes). For use with all types of electrical safety hats and caps. Same as FLF but NO METAL PARTS! Long neck for extra wind protection.

Model FLN-E (Small and Large sizes). Has yellow Neoprene-coated outer fabric for exceptional warmth retention and resistance to all wind and weather (sleet, snow, rain!) conditions. Extra long neck. NO METAL PARTS makes it ideal for use with electrical safety hats and caps.



Model MF Mouthpiece for Models FLF, FLF-I and FLF-Z for use where face protection against cold and wind are necessary. Snap on! Same high quality fabrics.



Model FLK (Universal size). 100% Navy Blue wool. Fits all heads. May be used separately or with other winter liners for greatest warmth and comfort.

Model HLP (Universal size). Features rayon screen laminated within two layers of wet strength paper. Cotton edge binding. Form fitting, highly absorbent, costs very little. For perspiration absorption and for use as a sanitary "visitor's" liner.

For the BEST... for Maximum warmth and comfort... ORDER NOW!

The **FIBRE-METAL** Products Company | CHESTER PENNA

In CANADA: Fibre-Metal (Canada) Limited, Toronto

See us at The NATIONAL SAFETY SHOW—Chicago—Booth 179-180

For More Information Circle No. 43 on Reader Service Card.

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YOUR Resistance Welding Electrode NEEDS Are OUR Business!

Whether it be:
TIPS:
ROD or BAR:
SEAM WELDING WHEELS:
FORGINGS:
CASTINGS:
HOLDERS:
ADAPTERS:

SPECIAL WELDING DIES or FIXTURES: TIPALOY *has them.*

BUY TIPALOY and save money!

TIPALOY can supply you with:
RWMA Class #1, Tipaloy #100
RWMA Class #2, Tipaloy #130*
RWMA Class #3, Tipaloy #200
and other RWMA classes of alloys to fit your needs.

It is unwise to pay too much, but it is worse to pay too little!

Use TIPALOY and get 30% to 100% more performance for your money than you are now getting.

BUY TIPALOY and get TIPALOY QUALITY

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*TIPALOY #130 cast and processed under our patents.

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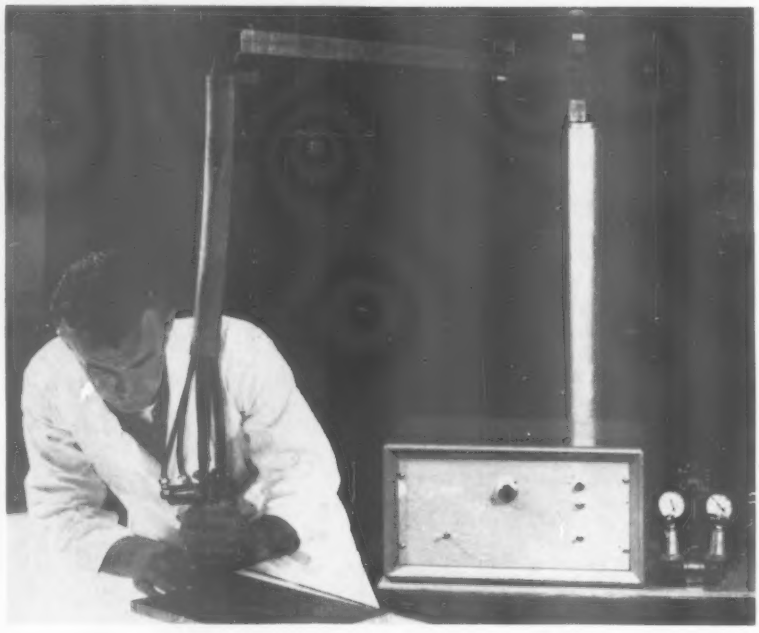
DETROIT 11, MICHIGAN

Circle No. 98 on Reader Service Card.

NEW PRODUCTS



High Speed Splice Welder For Joining Honeycomb Core

Hexcel Products Inc., has developed a new splice welder for high-speed precision joining of honeycomb core materials. It averages twelve to fifteen welds per second. The best you can get on a comparable hand welder is one weld per second.

The unit consists of transistors and other solid state devices; it has only one electron tube. Its solenoid valve is good for at least 10-million operations.

The welder includes an air-cylinder operated tweezer head, solenoid valve, air pressure regulators, a tweezer head support beam, and cables and connectors.

The weld pulse is automatically controlled; the welding points get current only for the time set. Cylinder pressure is adjustable. The operator merely presses the trigger on the grip to make a weld, keeps holding it to weld repeatedly.

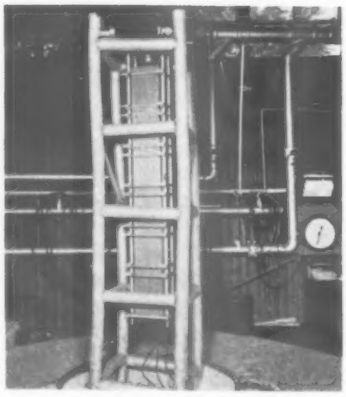
Both welding frequency and interval spacing are adjustable. The splice welder will make high quality welds in 0.001- to 0.010-inch metal.

Circle No. 200 on Reader Service Card

Boron-Free Brazing

Nicrobraz 50, a nickel base stainless brazing alloy designed for high temperature applications, was used by Stainless Processing Div., Wall Colmonoy Corp., in furnace brazing atomic reactor heat exchanger cores made of thinwall stainless steel tubes. Core (right) is inside fixture.

The alloy contains no boron, thus there is little diffusion into the 302 stainless, and service erosion in circulating hot water (600F) is unlikely. Nicrobraz 50 joints are strong and leakproof. The low brazing heat (1850 F) minimizes distortion.



Circle No. 201 on Reader Service Card

Automatic Metallizing

High pressure, high-velocity Mogul-electric Metallizing guns developed by Metallizing Company of America, Inc. permit automatic spraying at high speeds. Photo shows engine valves in moving belts being sprayed with aluminum which forms a protective alloy when heat treated.

Guns feature constant-speed drive for close control of metal spray. Gives dense, fine coatings of strong, ductile, machineable metal with little oxide or dust, regardless of the wire.

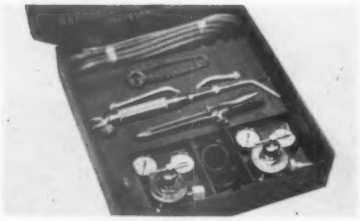
Circle No. 202 on Reader Service Card

Resists Extreme Heat

A new line of lightweight asbestos clothing—coats, leggings, cape sleeves, coveralls, sleevelets, spats, pants, chaps and aprons—that will shed molten metal at 3000 F without damage or inner discoloration, has been announced by American Optical Company. Called Thermogarb, the fabric offers 50 percent greater abrasion resistance than ordinary asbestos, is almost twice as strong as thicker, heavier fabrics. It reflects 50 percent of radiant heat.

Circle No. 203 on Reader Service Card

Welding And Cutting Outfits



The Harris Calorific Company has announced four new welding and cutting outfits.

1225-C (shown): Heavy-duty industrial outfit, complete with regulators, cutting attachment, welding torch and tips, and hose. Cuts 6 inch, welds ½ inch. 1900-C: For auto and hobby work. Has torch, tips, regulators cutting attachment, and hose. Cuts 3 inch, welds ½ inch. 7500 (propane) and 7800 (acetylene): designed for scrapyard cutting. Both include cutting torches and tips, regulators, and hose.

You get a lighter and goggles with each outfit.

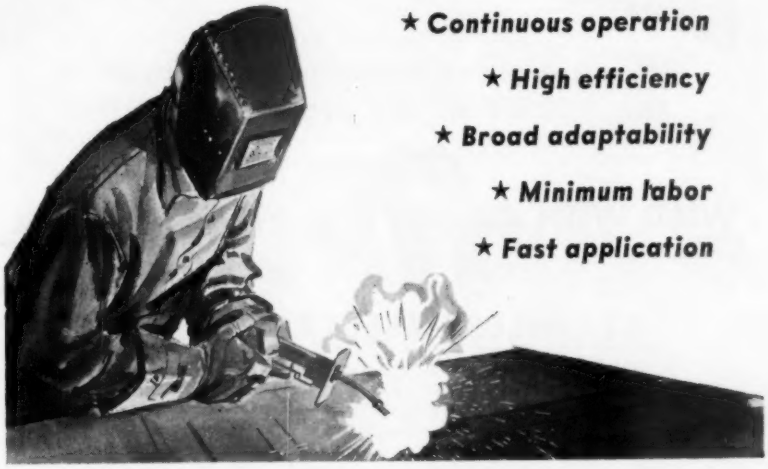
Circle No. 204 on Reader Service Card

NOW IT'S READY!

New Ranomatic *Wire*

For Automatic and Semi-Automatic Hardsurface Welding

RANITE manual rod quality now available in tubular coil wire for automatic and semi-automatic hardsurface welding



★ *Continuous operation*

★ *High efficiency*

★ *Broad adaptability*

★ *Minimum labor*

★ *Fast application*

RANOMATIC will be sold through your local **RANITE** distributor. For detailed information and prices ask him for bulletin No. R101, or write direct to Rankin Manufacturing Company.

RANKIN MANUFACTURING COMPANY

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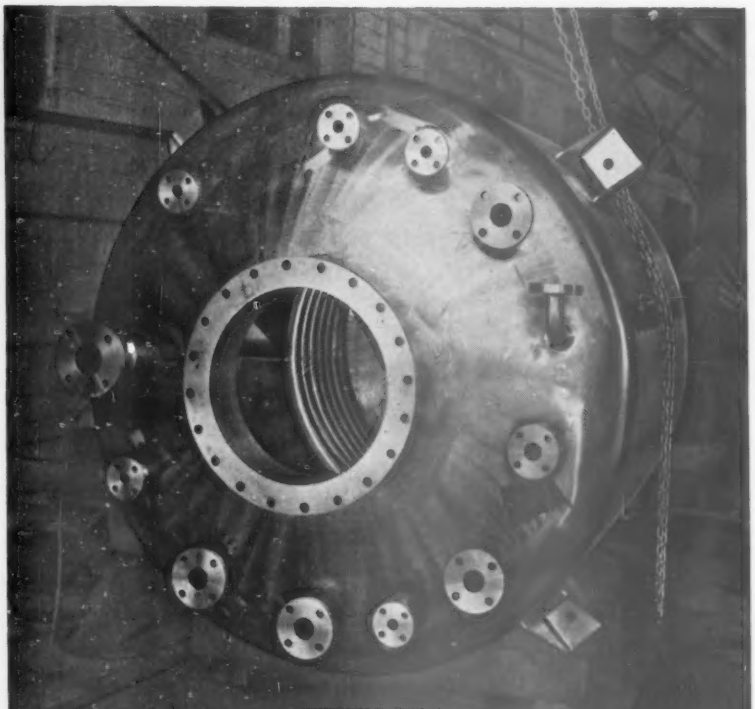
For More Information Circle No. 80 on Reader Service Card.



Job report courtesy of
Superior Welding Co., Decatur, Ill.

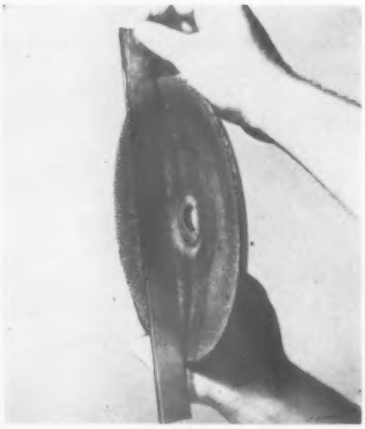
When welded stainless must protect the PURITY of the products handled

WELD WITH ARCOS

STAINLESS ELECTRODES

This highly polished kettle is fabricated from type 304 ELC stainless steel. In use, it must process chemicals without a trace of contamination. Arcos CHROMEND 19-9 Cb Electrodes were selected by the fabricator to assure a weld metal of high uniformity . . . one whose chemical composition would not break down under corrosive attack and contaminate the product. Welding was done by manual arc. When you, too, must safeguard product quality, specify Arcos Electrodes for the job. ARCOS CORPORATION, 1500 South 50th Street, Philadelphia 43, Pa.

For More Information Circle No. 17 on Reader Service Card.



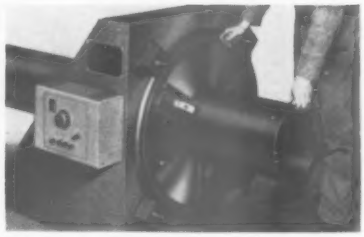
Faster Weld Grinding

A new grinding wheel, shaped to speed weld grinding, has been introduced by Bay State Abrasive Products Company. Called Koolie Hat, the wheel's dish-shape permits a lower angle with the work; grinder control is better without the jitter and bounce. This results in less fatigue, less accidents.

The narrow, radial contact between wheel and work gives high wheel speeds for fast weld removal without high heat.

Koolie Hat wheels come in 7- and 9-inch diameters, ¼ inch thick.

Circle No. 205 on Reader Service Card



Pipe Headstock

A new powered pipe rotator headstock, designed to simplify and speed welding on pipe fabrication, has been developed by the World Electric Co.

The rugged, portable rotator positions, clamps and rotates pipe for manual or automatic downhand welding. It is built in four sizes to handle these pipe ranges: 1 to 12 inches, 8 to 24 inches, 16 to 36 inches, and 20 to 48 inches. The speed range for the units is 2 to 160 ipm. The rotator is operated with a single lever, has a 3-jaw chuck and a detachable variable speed electrical control unit.

Circle No. 206 on Reader Service Card

New X-ray Film Base

Cronar, a tough, fast-drying film base material developed by E. I. Du Pont de Nemours & Co. is being used in the company's Type 506 fine grain and Type 510 extra fine grain x-ray film. This base resists stretching and shrinking under varying temperatures and humidity.

The new film is expected to find application in close tolerance work such as in the missile and space equipment industries. It will be used for x-ray measurement, as well as to other standards.

Types 506 and 510 film packaged in the company's Day Pack Rolls will also be available on polyester base.

Circle No. 207 on Reader Service Card

New Torch Cuts 30 Inches

A natural gas cutting torch that can slice through 30-inches of metal in a single pass has been introduced by Linde Co., Div. of Union Carbide Corp. The new Oxweld C-66 cutting torch is said to have the largest gas flow and the widest cutting range of any natural gas hand cutting torch.

Interchangeable injectors allow use with either low or medium-pressure natural gas. Spring-loaded assembly provides uniform mixing of gases and eliminates flashback. Quality construction assures long life despite severe abuse.

More than 40 different Oxweld nozzles, including long bendable nozzles, are available for use with Oxweld C-66. The torch weighs only 3 lb. 14 oz. Standard models are 27¼ in. long with 75° head angle. Longer and shorter models for special operations can be supplied with head angles of 45°, 75°, 90°, and 180°.

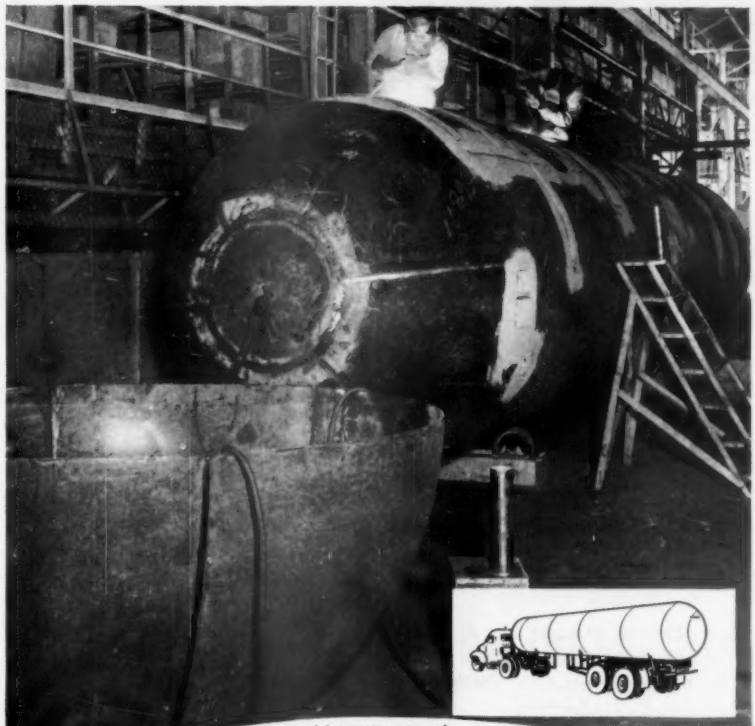
Circle No. 208 on Reader Service Card

Timing Controls

A new, economy line of electronic controls for resistance welding equipment has been introduced by Alphil Spot Welding Mfg. Co. The Meteor line features plug-in panels for easier servicing. There are four models: 1A, a weld timer, primarily for foot operated machines; 2A, a squeeze-weld timer for air operated welders; 3B and 5B, sequence timers that permit fine control and that can be applied to automatic machines.

Circle No. 209 on Reader Service Card

How X-Ray Quality Welds Make Low Alloy Steels Pay Off



Job report courtesy of Superior Tank & Construction Co., Los Angeles, Calif.

WELD WITH ARCOS

LOW HYDROGEN ELECTRODES

The vessel being welded is part of an L.P.G. tank truck. For high strength with low weight—USS "T-1" steel is used and welded with Arcos Ductilend 110 Electrodes. These tanks meet or exceed ASME code requirements . . . and all Ductilend 110 welds qualify with X-ray soundness. Ductilend 110 is an Arcos Low Hydrogen Electrode especially developed for welding high strength notch tough steels of the 110,000 psi tensile strength range. Data sheet on request. ARCOS CORPORATION • 1500 South 50th Street, Philadelphia 43, Pa.

For More Information Circle No. 18 on Reader Service Card.

NOW ... CHECK with your LINDE DISTRIBUTOR for *Oxweld* APPARATUS, too

With the *Oxweld* line of quality oxy-acetylene apparatus added to this list, he's your fastest, most complete source of dependable, top-name welding and cutting equipment:

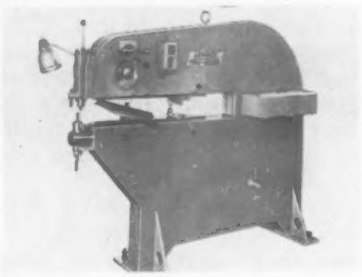
- ☐ OXWELD apparatus and supplies
- ☐ PUROX apparatus
- ☐ HELIARC apparatus
- ☐ SIGMA apparatus
- ☐ UNIONMELT apparatus
- ☐ PREST-O-LITE small tanks, appliances, and acetylene
- ☐ LINDE industrial gases

Your LINDE distributor is a welding specialist, superbly equipped and stocked for immediate delivery of a full line of quality products. To his already extensive list, the *Oxweld* line adds the most efficient high quality gas welding materials available today. There's a LINDE distributor near you. Call him for *all* your welding needs. Linde Company, Division of Union Carbide Corporation, 270 Park Avenue, New York 17, N. Y. *In Canada,* Union Carbide Canada Limited, Linde Gases Division, Toronto.

"Oxweld", "Purox", "Heliarc", "Sigma", "Prest-O-Lite", "Linde", and "Union Carbide" are registered trade marks of Union Carbide Corporation.

Linde UNION CARBIDE

For More Information Circle No. 64 on Reader Service Card.



It Shears, Forms, And Pierces

A new machine introduced by Lennox Tool and Machine Builders cuts in the center of ¼ inch mild steel plate without a starting hole. The rugged Model TE-250, with easy-to-reach, right side controls, has an edge-cutting capacity of 1 gage in mild steel, 5 gage in stainless steel. It has a 49½-inch throat. The unit cuts straight, circular, inside or irregular shapes, slots and louvers, beads, planishes, flanges, edge bends, joggles, nibbles, and pierces holes.

Circle No. 210 on Reader Service Card

It Pierces, Notches, And Blanks

A 500-ton capacity press has been introduced by Warco Division, Federal Machine and Welder Co. for production piercing and blanking of aluminum. The rugged, welded steel press operates at 30 strokes per minute, will take nearly 20 feet widths. It is double back geared with twin drive and has a pneumatic clutch and brake.

Circle No. 211 on Reader Service Card

Vacuum Chamber

A new chamber, designed for either electron beam welding in a vacuum, or for tungsten welding in inert gas, has been developed by Berkeley-Davis Inc. The chamber is 3-feet across, 5-feet long, and has four view ports and six glove ports. A longitudi-

nal crawler and a small positioner position the work.

The chamber will pump down to 1×10^{-7}, will reach 1×10^{-5} in 23 minutes. Over a 12 hour test, the leak rate is 2.3 microns an hour. The chamber and inside tooling is of highly polished stainless steel to reduce out-gassing.

Circle No. 212 on Reader Service Card

Stops Condensation

A new Water Mizer control, Model ES-ZO, has been introduced by Van Vooren Products to eliminate condensation on welding equipment. It's done through the use of two solenoid valves and delayed time delay, in conjunction with thermostats, for water flow control. The control stops condensation on transformer and ignitrons and regulates water flow to machine load.

Circle No. 213 on Reader Service Card

Universal Bridge Glasses

A plastic frame safety glass line, designed to fit nine out of ten faces without adjustment, has been developed by Sellstrom Mfg. Co. Called Sell-Fit, glasses have a comfortable, broad and continuous bearing bridge, are balanced, and securely supported.

Sell-Fits look like personal glasses, come in spatula or vinyl coated cable temples, and in flesh and charcoal colors. Two models have sideshields.

Circle No. 214 on Reader Service Card

Spray Heat Indicator

Aerosol packaging of Tempilaq temperature indicating coatings has been developed by Tempil Corp. Forty heat ratings, from 100°F to 650°F are available in the spray can, or in standard bottles with applicators. Higher temperature ratings (to 2500°F), available only in the bottle, are being perfected for the aerosol can.

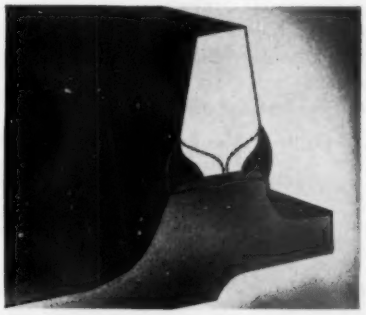
The spray can is a convenient method of coating large surfaces with Tempilaq.

Circle No. 215 on Reader Service Card

Iron Powder Electrode

West-ing-arc Department of Westinghouse Electric Corp. has developed a new electrode for structural and plate welding, wrought iron, low and medium carbon steels, low alloy steels, copper bearing steel, and low or medium carbon cast steel. The company added iron powder to the standard E-6012 electrode to get: better arc action, finer metal drop transfer, and superior slag characteristics. The Zip-12 is said to make lap and fillet welding faster.

Circle No. 216 on Reader Service Card



New Shape

A grouser bar shaped to reduce installation time and welding has been introduced by Allied Steel & Tractor Products, Inc. The new grouser can be quickly welded to the worn grouser with a single welding pass. The design permits the use of low-cost welding rod.

Made of the same shock resistant steel as other Grip-Lug grouser bars, the new shape work-hardens to provide peak service, least down time.

Circle No. 217 on Reader Service Card

Magnetic Particle Inspection

An inspection system has been put on the market by Instruments Div., the Budd Company, that detects defective welds, cracks, inclusions, and other flaws. Once called Permaweld, now Recordaflux, system successfully measures the diameters of spot welds in stainless steel; there is a direct correlation between the diameter and tensile shear strength of a spot weld.

Solution, poured or sprayed on work, sets up in eight or 20 minutes; then it can be viewed on the work and washed away, or stipped off and viewed and copied for a record.

Circle No. 218 on Reader Service Card

It's GOOD BUSINESS to DO BUSINESS with your LINDE DISTRIBUTOR because...

Your LINDE Distributor carries a *complete* line of all the welding and cutting equipment and supplies you need in your business. These are products recognized for their outstanding high quality and efficiency. In most instances, he can fill your order *from stock*, to save you time and effort.

Your LINDE Distributor anticipates your requirements... *knows your business*... is ready and able to fulfill your needs promptly. He has the experience of a welding specialist... which means good *service, quickly*.

Your LINDE Distributor is a local, independent business man—just as you are. He appreciates your business and wants repeat orders.

Your LINDE Distributor has the full resources of LINDE COMPANY behind him. For 50 years, LINDE has been a leading producer of top-quality welding and cutting equipment and materials—famous for know-how and service.

Your LINDE Distributor is as convenient to you as your telephone—call him for all your welding and cutting requirements. If you have not yet made his acquaintance, look in the Yellow Pages under "Welding Supplies." Or write Dept. 330. LINDE COMPANY, Division of Union Carbide Corporation, 270 Park Ave., New York 17, N.Y.

Linde UNION CARBIDE

"Linde" and "Union Carbide" are registered trade marks of Union Carbide Corporation.

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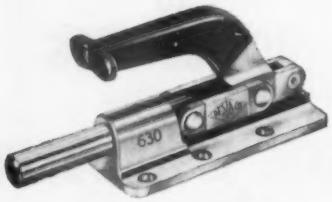
IT'S A FACT

YOU CAN DO BETTER WITH

DE-STA-CO

TOGGLE CLAMPS



LIKE THE NEW MODEL 630

Designed for jobs requiring fast holding action, the new 630 is a medium duty, plunger type that locks in either push or pull position—has holding pressure of 1600 pounds. Flared end, heavy Vinyl-covered safety handle. Solid one piece forged base—large diameter bearings—heavy steel linkage—plunger copper plated with Irrelac finish.

OVER 140 OTHER MODELS

Choose from 13 standard styles, over 140 models—holding power from 50 to 12,000 pounds—Templates available on request.

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YOU CAN DEPEND ON DE-STA-CO

DETROIT STAMPING COMPANY
350 MIDLAND AVENUE
DETROIT 3, MICHIGAN

Circle No. 32 on Reader Service Card.

Miniature Welding Power

A stored energy power supply, designed for electronic welding, has been developed by Hughes Aircraft Company. The unit (VTW-29) gives step-free adjustment of power of 0.01- to 40-watt-seconds in 0.001 second. A pulse width of one millisecond assures no burning or discoloration of metal. Weld speeds are up to 120 spots a second. Cabinet takes only a square foot of space. All controls and watt-second meter are mounted high on the cabinet for easy visibility.

Circle No. 219 on Reader Service Card

Cut Corrugated Steel

A fast and convenient cutting tool for corrugated steel, including tough pitch or asbestos coated, is Fenway Machine Co.'s Portable Nibbler, Model MNC. The lightweight of the hand tool permits corrugated metal to be accurately measured and cut at installation.

The nibbler's punch and die action forces metal chips downward, precluding face and eye injuries. It cuts small work without changing shape, cuts 2 inch circles.

The electric or air-powered unit features precision cut, hardened gears and anti-friction bearings on rotating parts.

Circle No. 220 on Reader Service Card

Layout Blocks

Two new models and sizes in layout blocks or welding platens have been announced by Acorn Iron & Supply Co. The working surfaces and edges are machined to .005-inch degree of flatness. Square holes allow clamping or spacing.

The new models bring the total number of different sizes to six.

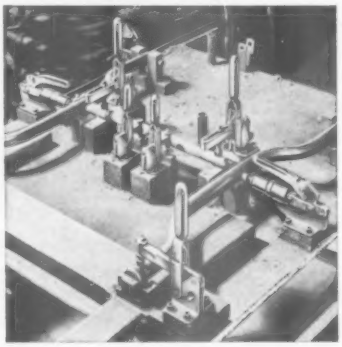
Circle No. 221 on Reader Service Card

IT'S A FACT

YOU CAN DO BETTER WITH

DE-STA-CO

TOGGLE CLAMP SECURITY



BECAUSE when you have the work held by De-Sta-Co clamps you know it will stay put until the job is done.

BECAUSE there's a De-Sta-Co clamp immediately available with just the holding power you need for any job—large or small.

BECAUSE you can choose from over 140 models that will push, pull or lock with forces from 50 to 10,000 pounds.

FOR MORE FACTS
WRITE FOR INFORMATIVE TOGGLE CLAMP CATALOG
YOU CAN DEPEND ON DE-STA-CO

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DETROIT 3, MICHIGAN

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Circle No. 22 on Reader Service Card.

AIR ROCKER SPOT WELDERS

- Equipped with two-stage foot switch and solenoid valve. First stage brings welding tips together only, then depressing into second stage starts the welding.
- Air cylinders are connected direct so tip pressures may be easily calculated from air pressure.
- High welding speeds may be obtained with the best welding pressures with little operator fatigue.
- Built-in control combinations are available.
- Full-length side door gives easy access to all internal parts.

ATOMIC SPOT WELDING COMPANY

DEALER INQUIRIES INVITED

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TILLMAN

GLOVES-GARMENTS

WELDORS BUY FROM YOUR DEALER

WELDING GLOVES MITTENS AND GARMENTS NOW IN POLY BAGS

BRAZILIAN DEERSKIN
THE "STAY SOFT" LEATHER
GLOVES AND MITTENS

John Tillman & Company
1561 W. 19th St.
Long Beach, California

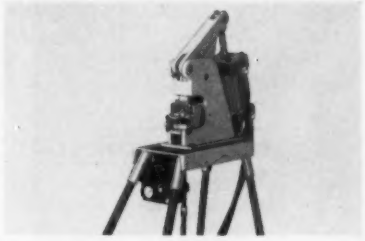
Circle No. 97 on Reader Service Card.

Insulating Coating

Zirconia (ZrO_2) coating is available for application by the Plasmarc plating process, a Linde Company, Division of Union Carbide Corporation development. The coating is primarily an insulator.

Plasmarc is used to coat and to fabricate shapes, using materials having ultra-high melting points. Tungsten, and other refractory metals have been applied to graphite, steel, aluminum, brass, and moly.

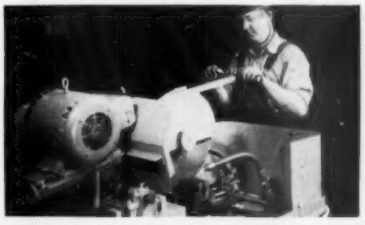
Circle No. 222 on Reader Service Card



Compact Air Press

A new press has been introduced by Vogel Tool & Die Corporation to accommodate Arc Fit tooling, a Vogel product which notches standard pipe and tubing to form joints for welding and brazing. With tooling (extra) press can readily notch standard pipe up to 2-inch size and tubing up to 2⅜-inch O.D. Unit shown is 8 ton capacity. Tooling (shown) will notch up to 1000 pieces per hour.

Circle No. 223 on Reader Service Card



Toolroom Cutting Unit

Wallace Supplies Mfg. Co. has introduced their Flexi-Modular cutting machine with these features: Clean cuts on the hardest high speed tool steels; no measurable metallurgical change to the steel; reduction of cutting time from minutes to seconds; and, quick switch from job to job with the fast-acting work holder. Machine can chop or oscillate, uses 14 inch rubber wheels to reduce changes. Cutting speed: 6 to 10 seconds per square inch.

Circle No. 224 on Reader Service Card

SINGLE

inch of shunt travel controls full range of current

M&T Murex AC
Industrial Arc Welder

One inch of shunt travel adjusts for entire output current range • Shunt is rigidly, permanently mounted, chatter-free • Patented dual-coil transformer affords balanced electrical circuit • Promotes smooth, steady arc under all welding conditions • Glass insulated windings add to transformer life • Write for data sheet that tells you more.

M-T MUREX welding products

METAL & THERMIT CORPORATION
General Offices: Rahway, New Jersey

Circle No. 70 on Reader Service Card.

For More Information Circle No. 2 on Reader Service Card.

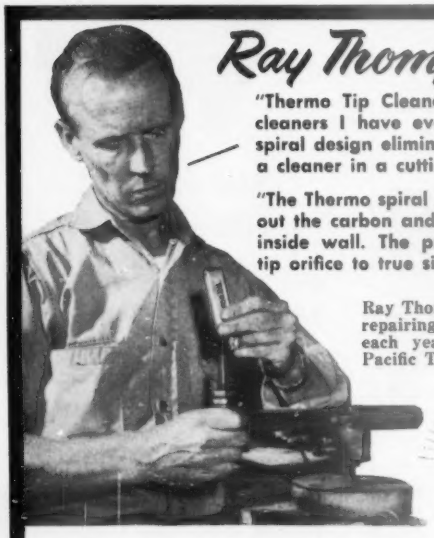
ACRO WELDER MFG. CO.
MILWAUKEE
WELDING ENGINEERS
MACHINERY BUILDERS
ESTABLISHED 1936

ACRO® general purpose spot-projection-butt-seam resistance welding machines.

ACRO-ARC® special purpose production welding machinery employing automatic arc welding processes.

ACROMATIC® special purpose production welding machinery employing resistance welding processes.

ACRO-MAGNETIC® magnetic force spot, projection, and percussion welding machines.



Ray Thompson says...

"Thermo Tip Cleaners are the safest and best cleaners I have ever used. The non-breakable spiral design eliminates the hazard of breaking a cleaner in a cutting tip.

"The Thermo spiral does a better job of working out the carbon and slag without damaging the inside wall. The precision tolerance keeps the tip orifice to true size, giving a straight flame."

Ray Thompson is a recognized expert, repairing thousands of cutting tips each year. He is employed by the Pacific Tip Co. of Los Angeles, Calif.

Use Thermo Tip Cleaners and cut your tip repair costs, at the same time increasing your cutting efficiency. The only cleaner with a non-breakable money-back guarantee.

Send for a free sample today and find out for yourself why Thermo Tip Cleaners are better.

All progressive welding supply dealers stock Thermo Tip Cleaners.

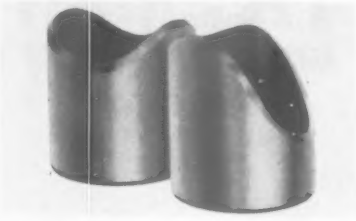
THERMACOTE Company
108 SOUTH DE LACEY AVENUE • PASADENA, CALIFORNIA

For More Information Circle No. 96 on Reader Service Card.

Grinder Bevels Pipe

A new grinder developed by E. H. Wachs Company will make accurate bevels on 4- to 18-inch pipe. Called Bev-L-Grinder, unit provides accurate bevels on steel, stainless steel, high alloy steel, or aluminum pipe, without changing the metal's properties. Many bevel angles are obtainable and the cutting action is fast and easy to control. Guarded 6-inch cupped grinding wheel is powered by a 6,000 rpm air motor.

Circle No. 225 on Reader Service Card



Preshaped Fittings

Allied Piping Products Co., Inc. has announced the availability of saddle fittings in 45 degree angles, as well as 90 degree fittings already available. Preshaping is aimed at reducing the high cost of pipe fabrication.

Fittings are of high strength seamless tubing in three weight schedules. They come in A-53 for most piping requirements and A-106 Grade B for higher pressures. Welding sizes: 1 through 12 inches, all beveled for welding. Special fittings, 1 through 36 inches, in aluminum, alloy, or stainless steel, are available in any angle.

Circle No. 226 on Reader Service Card

Circle No. 87 on Reader Service Card.

Never before! the *FIRST* **truly REVERSIBLE**

Welder's Glove

NO exposed seams on EITHER SIDE!

PERFECT FIT on EITHER HAND!

FRONT and BACK LOOK ALIKE

PACKED SINGLY

Buy 3 instead of a pair. Can outlast 2 or 3 pairs.

It took 8 long years to design and perfect this truly interchangeable glove. Finest quality HORSEHIDE full fleece lined. Ask your dealer or write us.

SO DIFFERENT it's PATENTED!
(U. S. patent No. 2,617,109)

16 PAGE CATALOG
Complete line of work gloves, welding gloves and safety clothing.

SINGER GLOVE MFG. CO.
860 W. Wood St., CHICAGO 22, ILL.

SEE OUR AD IN WELDING DIRECTORY

"Jorgensen" and "Pony"

CLAMPS

Favorites in the industry for nearly sixty years. Write for free 32-page catalog.

sold through leading distributors

ADJUSTABLE CLAMP CO.

"the clamp folks"
419 N. Ashland Ave., Chicago 22, Ill.

Circle No. 3 on Reader Service Card.

Dust And Splash Stoppers

Flexible frame safety goggles especially louvered to stop dust (front and rear), and splash (rear only) have been developed by Welsh Mfg. Co. Frames cushion-fit face, won't corrode or conduct electricity, provide greater ventilation and visibility. Available in clear or green frame with clear or green single lense.

Circle No. 227 on Reader Service Card

Fast Plate Beveler

The American Pullmax Co. has introduced their X-8 Beveler as a fast, easy, accurate way to bevel small plate sections for welding. The machine has a serrated cutting wheel that feeds the work through the machine as the bevel is neatly cut from the edge of the plate. Users say the machine will cut to 12 times faster than old methods.

Pullmax Bevelers come in models that cut 30-, 37½-, or 45-degree bevels.

Circle No. 12 on Reader Service Card

Miniature Torch

A miniature torch which uses gas or acetylene to produce intense pinpoint flames for close tolerance work is now available from Microchemical Specialties Company.

The torch is only 7 inches long from tip to gas connection and weighs just three ounces. It features finger tip mixer controls for fine adjustment of flame. Five tips, from .004-inch to .030-inch bore diameter, are available.

Circle No. 229 on Reader Service Card

DOUBLE

benefit of controlled arc: better welds, faster welding

M&T Murex CAPS* Controlled Arc Power Supply

Rectifier-type, constant voltage welder for semi or full automatic welding • Improves weld quality • When teamed with constant rate wire feed, arc length, deposition rate remain constant despite fit-up variations • Bead shape is more uniform; stubbing and burnbacks are greatly reduced • Economical to install and operate • Write for data sheet.

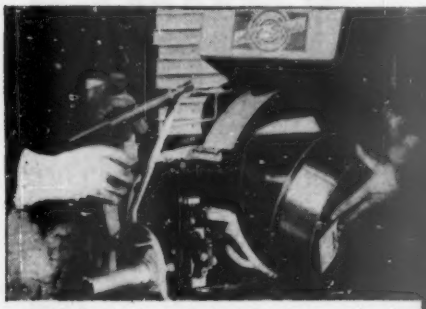
*Trademark

M&T MUREX welding products

METAL & THERMIT CORPORATION
General Offices: Rahway, New Jersey

Circle No. 71 on Reader Service Card.

For More Information Circle No. 4 on Reader Service Card.



Loading 10 lb. spool of #4043 aluminum wire at Michael Flynn Manufacturing Co., Philadelphia. Aluminum in this particular spool was used in welding curtain walls for skyscraper at 2 Broadway, New York City.

now you can get
All-State Spoolarc®

SPOOLED ALUMINUM

in all grades, all types
precision layer level
wound on
1 lb. and 10 lb. spools

Wire goes from extrusion and light draw to ALL-STATE'S precision spooling machines where it is layer level wound for smooth, trouble-free welds.

Types available: 1100, 4043, 5052, 5154, 5183, 5356, 5556, 6061, 6063, *355,* 356, 716, 718.

Precision spooled in these sizes: .030, .040, 3/64, 1/16, 3/32, 1/8.
*down to 1/16 only

ALL-STATE *Spoolarc*® spooled aluminum wire meets federal and industry specifications. Spools are sealed in polyethylene bags plus desiccant to retain top quality from spooling machine to welding machine.

Complete stocks available from factories at White Plains, N. Y. and South Gate, California . . . and from branches at St. Louis, Missouri and Toronto, Canada. On sale at over 1000 distributors here and abroad.

Send for new free Aluminum Manual.

Distributor Stocked, convenient to buy. Economical to use.
ALL-STATE WELDING ALLOYS CO., INC., White Plains, N. Y.
Call WHite Plains 8-4646 or write for nearest distributor

GV METAL WORKERS...

are preferred by more shops than ever!

Here are a few of the reasons:

- GV metal workers will cut practically any material within their capacity; such as mild steel, stainless steel, aluminum, brass, copper, fibre, etc.
- GV metal workers are precision made of the best Swedish steel. The mechanism is enclosed and operates in an oil bath.
- GV metal workers are made in 5 different sizes. Capacities 5/64", 5/32", 15/64", 5/16".
- GV metal workers are known for their durability, strength, service and simple maintenance.

You simply can't afford to be without at least one GV metal worker, because it pays for itself almost from the very start.

Illustrated brochure on request.

U.S. DISTRIBUTORS

Homestrand MACHINE TOOL CORP.
392 West Putnam Avenue, Greenwich, Conn. • 203 TOwnsend 9-2558

For More Information Circle No. 55 on Reader Service Card.

Eye Protection

Two new models have been added to American Industrial Safety Equipment Co.'s Eye Gard Adapta-Spec line of safety spectacles. No. 471 features clear safety lens, spatula temples and partial side shield. No. 479 has green safety lens, cable temples and perforated side shields.

Made of durable butyrate plastic, the new frame and bridge fit the facial contour of more than 95 percent of wearers.

Circle No. 230 on Reader Service Card

Heavy-Duty Drills

Ten heavy-duty drills have been introduced by Porter-Cable Machine Co. for many industrial uses. They are designed for wood, metal, brick, cement block, and plastic drilling, with speeds from 750 to 5,000 rpm. One model is recommended for ductwork and sheet metal applications. It features a keyless chuck which can be tightened or released with a twist of the fingers. Besides pistol grips, the new series includes D handles for in-line drilling.

Circle No. 231 on Reader Service Card

A.C. Welder

A new line of 180-amp portable a.c. welders has been announced by Metal & Thermit Corporation. They are designed for medium duty and built to NEMA, REA, and UL specs.

The automatic volt-arc balance will give deep penetration at high amperage, a soft arc at low amperage for thin metals. There are no moving parts. The unit will take 1/16 to 3/16 electrodes. Two models have built-in charges or storage batteries.

The units operate from 230 amps a.c., give 15 to 180 amps current. The transformer is guaranteed five years against burnout.

Circle No. 232 on Reader Service Card

Circle No. 83 on Reader Service Card.

Remove Welding Fumes at the Source... with RUEMELIN FUME COLLECTOR

Welding shops equipped with Ruemelin Fume Collectors are assured of a clean shop atmosphere. Noxious fumes, heat and smoke are eliminated AT THEIR SOURCE. Improves working conditions . . . lessens fatigue . . . paves the way for increased plant production. Especially helpful in winter months when windows and doors are closed.

Note the new spring-loaded counterbalance mechanism which makes Fume Collectors much easier to handle.

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Mfrs. & Engineers • Sand Blast & Dust Collecting Equipment

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WELDING & BRAZING
FLUXES

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- ☐ 1. Cast Iron Welding Flux
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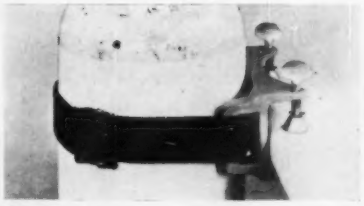
- ☐ 4. "Braz-Cast" Flux for Bronze Welding Cast Iron
- ☐ 5. Aluminum Flux for Cast Aluminum
- ☐ 8. Aluminum Flux for Sheet Aluminum
- ☐ 9. Stainless Steel Welding Flux
- ☐ 11. Tinning Compound
- ☐ 15. Welding Flux for Magnesium Alloys
- ☐ 14. Silver Solder Paste Flux for Silver Brazing

Order "Anti-Borax" Fluxes By Number

Manufactured Only By
ANTI-BORAX COMPOUND CO., INC.
FORT WAYNE, INDIANA

Circle No. 15 on Reader Service Card.

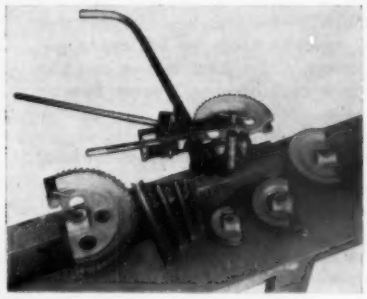


Gas Cylinder Support Bracket

Gas cylinders can be held rigidly in place on the edge of a table with a simple little bracket clamp now being made by Central Scientific Co.

The 2½-lb. cast iron bracket is clamped by means of two thumb screws. An adjustable strap holds the cylinders.

Circle No. 233 on Reader Service Card



Bench Bender

The new Wallace T-3 bench bender has direct lever operation for bending soft copper and aluminum up to 1½" diameter, and for bending annealed steel tubes up to 1" O.D.

Ratchet bending action is for steel tubes to 1-½". The two ratchet dies—1¼" O.D. and 1-½" O.D.—have cast-in ratchet teeth with ratchet lever attachment which gives one man the power of two men.

This bench bender uses the "Compression" type of bending which gives shorter radii without mandrel use and requires less hand power (rolls the bend in).

It can be used for right or left hand bending with tangents of about one tube diameter between bends.

Five (5) complete sets of dies: ½", ¾"; 1"; 1¼"; and 1½" O.D.

Circle No. 234 on Reader Service Card

Water-Cooled Spot-Weld Gun

A new spot welding gun, number 407, has been announced by Aro Spot Welder Division of Guthery Machine Tool Corp.

The water cooled gun has a capacity of 14,000 amps. It welds from lightest gauge up to twice ⅛". The 407 comes with 10" throat; however, extension arms are available up to 30".

Circle No. 235 on Reader Service Card

TRIPLE

benefits provided by this convenient, economical welder

M&T Murex AC-DC Combination Welder

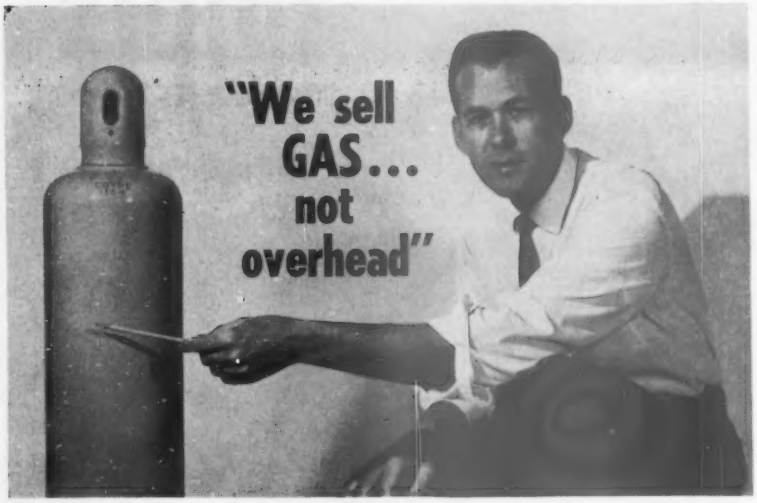
Has unique patented dual-coil transformer for smooth, steady operation, instant starting and recovery voltage • Single crank controls chatter-free shunt that slides only one inch for full, stepless range of output • DC delivered by non-aging, hermetically sealed silicon diodes • All in all: (1) long life, (2) low operating costs, (3) superior arc characteristics • Write for data sheet.

M&T MUREX welding products

METAL & THERMIT CORPORATION
General Offices: Rahway, New Jersey

Circle No. 72 on Reader Service Card.

For More Information Circle No. 31 on Reader Service Card.



"That's why we chose COYNE CYLINDERS—the acetylene cylinders that **hold more gas.** COYNE'S extra gas capacity means we sell **more** gas in every cylinder delivered to our customers. At the same time we also **cut** our handling, trucking and administrative costs because it takes **fewer cylinders to deliver the gas.**"

Check with COYNE—let them send you the dollar and cents facts on **how much** profit you get from this extra gas footage.

COYNE *cylinder company*

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H & M STANDARD MACHINES

"BEVEL-LAND" GRINDER . . . smooths pipe cuts and places the lands on bevels in a matter of seconds.

PATENT NO. 2,869,293

Save Manhours . . . Increase Profits

H & M Standard Machines give accurate, dependable pipe cutting and beveling results cut after cut . . . in the field or in the shop. The seven models of H & M Machines are designed to handle all sizes of pipe from 1½" - 36". H & M's are lightweight, easy to handle . . . and are built to withstand the toughest operating conditions. **WRITE FOR A CATALOG ON THE COMPLETE H & M LINE, TODAY!**

H&M PIPE BEVELING MACHINE COMPANY
311 E. Third St. DI 3-0241
TM Reg TULSA, OKLAHOMA

For More Information Circle No. 49 on Reader Service Card.

Indoor D.C. Welder

Built for durability and performance for indoor use is the new Silver Star d.c. rectifier type welder by Miller Electric Mfg. Co., Inc.

Since outdoor weatherproofing is saved, the buyer benefits by lower cost. Features include: stacking, space-saving design; rugged, good-looking cabinet, sealed semimetallic rectifier, lifetime cooling system, Cam-lok terminals, and electric control. Comes in two models with dual current ranges: Model H-3-SR, 40 to 295 and 75 to 450 amps; Model H-4-SR, 50 to 350 and 100 to 600 amps.

Circle No. 236 on Reader Service Card

Dye-Penetrant Inspection

A dye-penetrant inspection system for detecting surface flaws has been introduced by Picker X-Ray Corporation.

"Pixchek" can be used on metals, ceramics, glass and most plastics, company officials claim. A compact kit contains both spray and liquid cans for on-the-spot inspection. Bulk quantities for production lines are also available.

Flaws are made visible by the action of a chalk-white developer on a red dye. Interpretation of the "blood stain" pattern reveals the type of surface flaw in the material.

Circle No. 237 on Reader Service Card

Double Crank Presses

A 40-ton Rousselle press that is ideally suited for handling wide rolls or sheets of stock including plastics, paper, leather and sheet metal has been developed by Service Machine Co. It is adaptable for steel rule dies and a variety of multiple punching.

Three sizes are available with bed areas up to six feet. Standard die space can be increased from 12 to 24 inches. An electrically-controlled friction clutch provides rapid, shockless starting and stopping at higher speeds.

Circle No. 238 on Reader Service Card

Circle No. 23 on Reader Service Card.

BATEMAN
BANTAM
IRON WORKER

THE ONLY IRON WORKER OF ITS KIND ON THE MARKET TODAY

No Grinding Necessary After Cut. One Stroke Cycle Clutch Operated by Hand or Foot.

The Bateman "Bantam" cuts 2" x 2" x ¼" angles and ¼" x 4" flats. Standard punches will fit this machine. The Coper will cope 1¼" through ⅛" material. It will punch ½" hole through ¼" material. With the clutch open, the Bantam will make 44 strokes per minute. It is made of high-grade cast iron, with the clutch, pin and dog made of hardened steel. The blades are made with tool steel. It is powered with a fly wheel and gear drive, and uses a small ¼ hp motor, 1750 rpm.

Bateman Bantam with punch....$575.00
Shear only $495.00
Shipping wt. 750 lbs.

BATEMAN FOUNDRY & MACHINE
MINERAL WELLS, TEXAS

PORTABLE SANDBLAST GUN Complete: simply connect to air line

RUGGED—EFFICIENT

$27.50
(including one spare jet and 2 spare nozzles)

FOR THE LAB OR SHOP

A complete inexpensive sand blast unit for cleaning before and after welding. For sand blasting metal surfaces or small parts. Order one today. It pays for itself quickly.

LINDBERG PRODUCTS CO.
P.O. BOX 908W LAKEPORT, CALIF.

Circle No. 62 on Reader Service Card.

New Welding Glove

Imported Carpincho is the leather used by Singer Glove Mfg. Co. in a new line of welding gloves. This soft, supple leather is said to resist heat shrinkage better than any other leather known to the welding industry. It is tough, but soft and flexible.

The glove has extra-wide reinforcement in the thumb crotch, a point of greatest wear in most welding jobs.

Available in 13½" gloves and mittens. Also included in the Carpincho Line is a driver's-type glove.

Circle No. 239 on Reader Service Card

Wobble-Head Seam Welder

A new development by Precision Welder and Flexopress Corp., the Wobble Head Welder, is said to bridge the gap between circular seam wheel welders and ring projection welders. The welder is ideal for handling ring welding jobs from ¾ inches to 6 inches in diameter.

The electrode in the welder is a circular cup-type die running on an adjustable eccentric drive. The cup die works on edge, touching the workpiece with rolling—not sliding—point contact.

Circle No. 240 on Reader Service Card

Safety Eyewear

A new line of acetate frame safety glasses has been introduced by Bausch & Lomb. The frame features a one-size saddle bridge for all three eye sizes, and is available in flesh color (Model Y-15) and two-tone brown and crystal (Model T-16). It is claimed that the bridge construction provides a pressure-free fit. A maximum surface-to-face contact is achieved which distributes weight evenly.

The Y-15 and T-16 are available in three temple styles: Acetate spatula, acetate cable, and metal spatula. The new eyewear features Bal-Safe lenses in clear or Ray-Ban 1, 2, 3, or is available in clear Enduron plastic. These frames are not recommended for corrective-protective use.

Circle No. 241 on Reader Service Card

QUAD-RUPLE

welding versatility: manual, automatic, inert-gas, spot

M&T Murex Muretran* All-Purpose Welder

Most versatile welder ever developed • Quick changeover to manual, automatic, inert-gas (MIG, TIG), and spot welding • Unique plug-in timers for gas pre-flow, post-flow, high frequency drop-out, spot arc • Patented, dual coil windings in saturable shunt transformer • Sealed silicon rectifiers assure highest efficiency, long life • AC-DC or AC models • Write for data sheet. *Trademark

M&T MUREX welding products

METAL & THERMIT CORPORATION
General Offices: Rahway, New Jersey

Circle No. 73 on Reader Service Card.

For More Information Circle No. 44 on Reader Service Card.

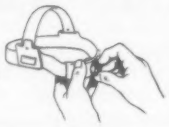
WELDING JOBS that must be done fast and well,

now more than ever, need helmets that offer the best in safety and comfort. Of necessity they must be lighter in weight, stronger and stoutly reinforced, non-warping, have higher resistance to heat, adjust easier, fit better and be simpler to clean and sterilize. All these qualities come in good measure when you select Flood's improved Fiber Glass Helmets with new FIT-RITE headgear.

No. 51-8F-2H HELMET

No. 51-2F-2H HELMET | No. 714-8F HANDSHIELD | No. 52-8F-2H HELMET | No. 53-2F-2H HELMET | No. 715-8F HANDSHIELD

INSTANT Head Size Adjustment



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HARD-N-TUFF **HARDENS**
TOOLS and PARTS
RIGHT IN YOUR OWN SHOP

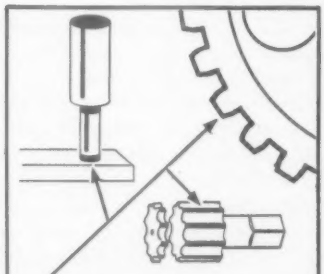
You can get three times more wear from tools and parts by putting every fast-wearing edge and surface through a simple 3-step operation — without special equipment — right in your own shop.

HARD-N-TUFF Steel Hardening Compound:
- Puts a file-hard surface on any steel, cast iron or iron-base metal in minutes.
- Leaves metal core tough, resilient, avoiding breakage.
- Hardens only the critical cutting, bearing or impact area.
- Super-hard surface will not crack or scuff off.
- Does not affect critical shapes or dimensions.
- Safe, non-toxic.

HARD-N-TUFF nitrides, chromizes and carburizes in one easy operation. Simply heat part, apply HARD-N-TUFF and reheat, then quench. That's all there is to it!

Order Your Trial Supply NOW.

Get 1 lb. cans for only $8.95



- Harden Critical areas only.
- Leave Tough Cores

Use HARD-N-TUFF on dies, jigs, fixtures, gears, bearings—any impact cutting or bearing surface.

IT'S THE SURFACE HARDNESS THAT COUNTS

Ask your Industrial Distributor or Write
HARD-N-TUFF CORPORATION
Box 275, Huntington, New York

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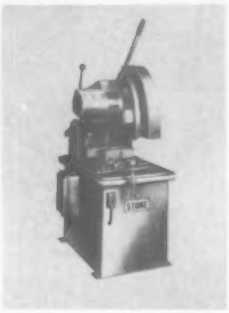


Heavy-Duty Cut-Off Saw

Stone Machinery Company's Model M-120 high speed cut-off saw is designed for heavy duty ferrous and non-ferrous cutting. Powered by a full 10hp ball-bearing induction-type motor, the unit's 20-inch blade will cut 4-inch ferrous solids and 6-inch structurals, and will handle 6-inch solids, 8-inch structurals and extrusions in non-ferrous metals. Cuts are made at less than four seconds per square inch.

Circle No. 91 on Reader Service Card

Air Rocker Spot Welders

These spot welder made by Atomic Spot Welding Company are equipped with two-stage foot switch and solenoid valve. First stage brings welding tips together only, then depressing into second stage starts the welding. Air cylinders are connected direct so tip pressures may be easily calculated from air pressure.

Built-in control combinations are available. Full-length side door gives easy access to all internal parts.

Circle No. 22 on Reader Service Card

Aluminum Fittings

A new line of cast pipe aluminum fittings is being manufactured by Wheaton Brass Works. The fittings are said to have superior weld-ability.

They include four types of aluminum welding reducers: welding elbow, welding neck flange, slip-on welding flange and blind flange. Six sizes—from 2" to 8" are available.

Circle No. 242 on Reader Service Card

Coyne Announces Consolidation

SOUTH SAN FRANCISCO: John P. Coyne, president of Coyne Cylinder Co., has announced the consolidation by exchange of stock with American Cryogenics, Inc., of Acetylene Cylinder Corp., Farwest Equipment Corp., and Coynde Cylinder, all of San Francisco, and the Sierra Oxygen Co., Reno; also, the acquisition of McKesson Appliance Co., Toledo, Ohio, for cash in excess of $1 million.

Coyne's cylinder manufacturing and distributing activities and McKesson's medical therapy equipment will further integrate the operations of American Cryogenics, owners of Marks Oxygen Co., Augusta, Ga. In addition to California properties, Coyne also owns a large plant at Memphis.

Messers. M. F. Coyne, John P. Coyne, and L. W. Fleischer of the Coyne group were elected officers and directors of American Cryogenics.

Liquid Carbonic Takes On Westinghouse Line

PHILDELPHIA: The Liquid Carbonic Division of General Dynamics Corporation will market Westinghouse Electric Corporation's welding products in its Middle Atlantic Region, including Philadelphia, Harrisburg/Lemoyne, and Wilkes-Barre, according to W. H. Crescenti, general manager. Westinghouse's welding products include a complete line of welding machines and electrodes, brazing alloys, and semiautomatic welding equipment.

COMING EVENTS

October 13-14: New England Regional Welding Conference, Kenmore Hotel, Boston.

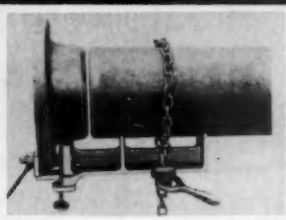
October 13-15: Western Welding Technical Conference and Welding Show, Santa Clara Valley Section, AWS, San Jose, Calif.

October 17-21: 42nd Annual National Metal Show, American Society for Metals, Philadelphia.

October 23-25: Convention and Trade Show, Associated Independent Rebuilders and Parts Suppliers, Chase Park Plaza Hotel, St. Louis.

Circle No. 59 on Reader Service Card.

SEE JEWEL FOR . . .



The JEWEL Flange Clamp
lines up the flange face at right angles to pipe end and holds until tacked. Takes size from 2½" to 16".

The JEWEL Pipe Clamp
. . . aligns and holds pipe for tacking. Two sizes: ½" to 8" and 8" to 16". Sturdy construction for hard usage.

The JEWEL Elbow Clamp
lines up welding elbows from 2½" to 8" at right angles to the pipe and holds them until tacked.

The JEWEL Angle Clamp
holds branch line at right angles to the main or headers. Takes any size main or branch from ½" to 12".

The JEWEL Pipe Marker
marks a perfect hole and saddle on any pipe up to 20".

Write For Details

Jewel Manufacturing Co.
1841 University Ave., St. Paul 4, Minn.

DOC TUFFY
TO THE RESCUE
WELDING ENGINEER
DOC! I'VE GOT A MILLION JOBS TO DO! JUST CAN'T GET TO THOSE RESISTANCE WELDING SPECIALS!
YOUR PROBLEM HAS A SIMPLE, PRACTICAL SOLUTION... CALL A TUFFALOY SPECIALIST!
Why burden your staff with the puzzles of resistance welding electrode design? Free up your engineers for the bigger, more pressing jobs.
Call in the Tuffaloy expert. He'll give you practical, money-saving electrode designs. Write or call your local Airco or Tuffaloy office. Today.
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For More Information Circle No. 107 on Reader Service Card.

IN 1936, MORT CLARK, then Vice-President of the world's largest sign manufacturer, wanted a welded galvanized sign frame. Every welder manufacturer said it couldn't be done . . . Mort Clark did it, received a check and certificate of achievement from the Lincoln Welding Foundation—and

MORT CLARK'S GALV-WELD ALLOY ORIGINAL & GENUINE

WAS BORN

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Eliminates corrosion areas produced by welding, so that weld will stand up under paint, WITHOUT rust, as on ornamental iron. Simply use residual heat from welding, or reheat, wire brush, and apply. No fluxing—No fumes.

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Circle No. 13 on Reader Service Card.

Harper Trucks Stocks In New Jersey

HARPER, KANSAS: The warehousing of their complete line of welding cylinder trucks at West Caldwell, New Jersey, has been announced by L. J. Hendrick, president, Harper Trucks, Inc. All seaboard states, plus Vermont, Pennsylvania, and West Virginia will be served.

The stocking arrangement is maintained by Harper's companion company, Tweco Products, Inc., at Tweco's Eastern Division Office and warehouse in West Caldwell.

McKay Machine Purchases Berkeley

YOUNGSTOWN, OHIO: A. J. Wardle, Jr., president of the McKay Machine Co. and L. J. Berkeley, president, Berkeley Company, Danville, Illinois, have announced that McKay Machine has purchased the Berkeley Co.

Berkeley is a producer of automatic arc welding equipment. McKay designs and builds sheet and coil processing equipment for automotive, steel, and appliance plants.

Square D Company Adds Factory Space

LEXINGTON, KY.: Another 68,400 square feet of factory space has just been added to the Square D plant here. This brings that plant's total area up to 238,000 square feet and lifts Square D's total factory space to more than 2 million square feet. This is an increase of 70 percent since the company's $30 million expansion program began 10 years ago.

Curtiss-Wright Offers Two Training Courses

PRINCETON, N. J.: Curtiss-Wright's Princeton Division is holding two courses in nondestructive testing this month. The first is on ultrasonic inspection techniques from October 3 through 7. The second is on industrial isotope radiography from October 10 through 14.

Circle No. 34 on Reader Service Card.

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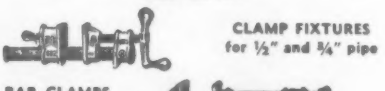

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Circle No. 30 on Reader Service Card.

Data Offered In This Month's Ads

Readers may obtain any of these free reference materials by circling the corresponding numbers on the Reader Service Cards

2: Welding machinery for special or general purpose welding is featured. **Acro Welder Mfg. Co.**

3: Clamps of all types are illustrated in a 32-page catalog. **Adjustable Clamp Co.**

4: Spooled aluminum in all grades and sizes is described. **All-State Welding Alloys Co., Inc.**

5: Metal cutting at low cost is explained. **Allison-Campbell Division, American Chain & Cable Co., Inc.**

6: Punch presses are described in a catalog giving specifications and prices. **Alva Allen Industries.**

7: Fabricating with a new metal arc gas shielded gun. **Air Reduction Sales Co.**

8: Offset spot welding tip holders of new design are described. **Air Reduction Sales Co., Tuffaloy Dept.**

9: Welding procedures for copper and copper alloys are the subject of Publication B-13. **American Brass Co.**

10: Goggles that fit practically every operator are described. **American Optical Co.**

11: Low-temperature silver brazing with special fluxes is described. **American Platinum & Silver Div., Engelhard Industries.**

12: Beveler for small pieces is illustrated in literature. **American Pullmax Co., Inc.**

14: Phosphor-bronze electrode is described in Bulletin W-17. **Ampco Metal, Inc.**

15: Fluxes for welding and brazing are listed. **Anti-Borax Compound Co., Inc.**

16: Metal removal with carbon air-compressed air process is completely described in literature. **Arcair Co.**

17: Stainless electrodes for product purity are discussed. **Arcos Corporation.**

19: Band saw design and operation are described. **Armstrong-Blum Mfg. Co.**

20: Positioning equipment is illustrated. **Aronson Machine Co.**

21: Welding accessories are featured. **Atlas Welding Accessories Inc.**

22: Spot welders are illustrated and described. **Atomic Spot Welding Co.**

23: A punch and shear for metal under 1/4-inch thick is featured in literature. **Bateman Fdry. & Mach. Co.**

24: Grinding wheels are discussed. **Bay State Abrasive Products Co.**

26: Carbon and graphite products are listed in a catalog. **Becker Brothers Carbon Co.**

27: Hydraulic tools for welding and fabricating are featured in colorful how-to-do-it booklet. **Blackhawk Mfg. Co.**

28: Receptacles and plugs in many sizes and designs are described in a bulletin. **Cam-Lok Div., Empire Products, Inc.**

29: Oxidation and scale removal is subject of informative bulletin. **Chemclean Products Co.**

30: Clamps for all jobs are described in catalog. **Cincinnati Tool Co.**

31: Gas cylinders are explained in literature. **Coyne Cylinder Co.**

32 and 33: Toggle clamps (over 140 models) are featured in catalog. **Detroit Stamping Co.**

34: Testing problems are discussed. **Detroit Testing Machine Co.**

35: Electrode holders are featured. **Duro Engineering Co.**

36: Welding tips and spot welding equipment are shown. **Eisler Engineering Co., Inc.**

37: Low-frequency induction heating is the subject of a brochure. **Electric Arc, Inc.**

39: Exhaust systems of all sizes and for all purposes are listed in descriptive catalog. **Engwald Co.**

40: Arc welding accessories and welding circuits are explained. **Erico Products Inc.**

41: Silver brazing with first flux-coated rod. **Eutectic Welding Alloys Corp.**

42: Heavy duty nibblers are featured in data. **Fenway Machine Co.**

43: Winter liners for safety hats and caps are featured. **Fibre-Metal Products Co.**

44: Fiber glass helmets are described and illustrated. **Flood Safety Products Co.**

45: Galvanizing of small parts and weldments is described in literature. **Galv-Weld Products.**

47: Brazing flux and its characteristics are explained. **Goldsmith Brothers.**

49: Special tools for difficult pipe cutting jobs are featured in catalog. **H&M Pipe Beveling Machine Co.**

50: Axle assemblies, jacks, couplers, and spindles are illustrated in catalog. **Hammer Blow Tool Co.**

51: Hardening tools and parts without special tools is described. **Hard-N-Tuff Corp.**

52: Hardsurfacing electrodes and wheel- and skid-mounted welders are featured in bulletins. **Harnischfeger Corp.**

53: Flame cutting with natural gas is discussed. **Harris Calorific Co.**

54: Versatile automatic welding equipment is featured in a bulletin. **Hobart Brothers Co.**

55: Metal workers made in five sizes. **Homestrand Machine Tool Corp.**

56: Welding dissimilar alloys quickly and easily. **International Nickel Co., Inc.**

57: Flux recovery equipment is the subject of a folder. **Invincible Vacuum Cleaner Mfg. Co.**

58: Electrode holders of aluminum-alloy with copper-alloy jaw inserts are illustrated and discussed. **Jackson Products.**

59: Clamps for various uses are described. **Jewel Mfg. Co.**

60: Consult your welding supply distributor about your welding problems. **Lenco, Inc.**

61: Consulting for welding and designing are explained. **Lincoln Electric Co.**

62: Portable sandblast gun is described. **Lindberg Products Co.**

63: Welding variables: Complex joints, fussy metals, and tricky fixturing are discussed. **Linde Co.**

continued on page 104

Circle No. 39 on Reader Service Card.

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Circle No. 36 on Reader Service Card.

DATA FEATURED IN ADS

continued from page 103

64: Oxweld apparatus is featured. **Linde Co., Division of Union Carbide.**

65: Welding supply distributors are listed. **Linde Co., Division of Union Carbide.**

66: Dye penetrant materials in spray cans are described. **Magnaflux Corp.**

67: Temperature indicators that melt at desired temperature are described in literature. **Markal Co.**

69: Oxygen cutting machines in a complete line are featured in detailed literature. **Messer Cutting Machines, Inc.**

70, 71, 72, and 73: Welders of all types for varied industrial uses are featured in literature. **Metal & Thermit Corp.**

74: Hard facing and rebuilding is subject of brochure. **Metallizing Company of America, Inc.**

75: Wire gun and powder gun hard facing is described. **Metco, Inc.**

76: Welding machinery for general maintenance and light production welding is featured. **Miller Electric Mfg. Co.**

77: Two catalogs on gas welding and cutting apparatus are offered. **National Cylinder Gas Division of Chemetron Corp.**

78: Regulator for all high pressure gasses are featured. **National Welding Equipment Co.**

79: Gas Cylinders are discussed. **Pressed Steel Tank Co.**

80: Hardsurface welding information and prices offered in bulletin. **Rankin Mfg. Co.**

81: Renting positioning equipment is explained. **Ransome Company.**

82. Backing rings for pipe welding are featured. **Robvon Backing Ring Co.**

83: Welding fume details described in literature. **Ruemelin Mfg. Co.**

84: Cryogenic equipment is the subject of technical literature. **Ryan Industries, Inc.**

85: Resistance welding supplies of all types featured. **S-M-S Corporation.**

87: Welder's gloves featured in 16-page catalog. **Singer Glove Mfg. Co.**

88: Weld cleaning is discussed. **G. W. Smith & Sons, Inc.**

90: Material evidence on welder quality. **A. O. Smith Corp.**

91: Chop-stroke, miter, and transverse-type cut-off machines described in literature. **Stone Machinery Co.**

93: Welder control is described in detail. **Square D Company.**

94: Welding in normally inaccessible areas is feature. **Tec Torch Co., Inc.**

95: Temperature indicating crayons are subject of literature. **Tempil Corp.**

96: Cutting tip cleaners are featured. **Thermacote Co.**

97: Gloves and garments for welders are described. **John Tillman & Co.**

98: Electrodes for resistance welding are featured in a catalog. **Tipaloy, Inc.**

99: Hot holders and how to eliminate them is illustrated. **Tweco Products.**

100: Better welding with automatic arc control is featured. **Vickers Incorporated.**

101: Combination welding and cutting units are described in literature. **Victor Equipment Co.**

102: Double notching pipe and tubing is featured. **Vogel Tool & Die Corp.**

103: Work holders for welding, soldering, and brazing are illustrated in literature. **Wales Strippit Inc.**

104: Stainless brazing is the subject of literature. **Wall Colmony Corp.**

105: Fabricating facilities are featured in catalog. **R. C. Mahon Company.**

106: High speed rebuilding of rollers and idlers is explained. **Rexarc, Inc.**

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